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HAS ADOPTED OIL AS FUEL.

One of the first steamship lines to adopt oil as a fuel is the American-Hawaiian Steamship Co., which operates a fleet of steamers between New York, San Francisco and Honolulu. The company has built nine steamers within the last two or three years to take the place of the old clipper vessels. The fleet consists of the American, Hawaiian, Oregonian and Californian, 8,000 tons each; Alaskan, Texan and Arizonian, 11,000 tons each, and the Nevadan and Nebraskan, 6,500 tons each. The last two steamers are designed for the San Francisco-Honolulu trade exclusively. They are provided with cold storage plants for transporting meats to the Hawaiian islands and fruit from the islands to San Francisco. The entire fleet is completed with the exception of the Arizonian, which will be finished in about two months. The Nevadan and the Nebraskan have already been fitted with tanks for carrying fuel oil, and the other steamers will be equipped with the apparatus as fast as possible. The Nevadan has made three round trips between San Francisco and Honolulu using oil as fuel, and the Nebraskan is now making her first trip. The distance covered by the Nevadan in the trips was 12,500 miles. The owners are satisfied that oil is the best fuel for them to use on their vessels from the results obtained from the Nevadan.

The Nevadan is equipped with Scotch boilers built to be worked at a pressure of 200 lbs. to the square inch, and to drive the ship at the rate of 11 knots an hour with coal as fuel. These boilers also furnish steam to the refrigerating plant, the steam winches, the blowers, the different pumps, the electric light plant, etc. The apparatus for using the oil was designed by V. F. Lassoe, superintending engineer of the American-Hawaiian Steamship Co., and Luther D. Lovekin, of the New York Ship Building Co., where the ships were built. In their system the oil is atomized by air introduced at low pressure, and the Howden draft system is used to heat the air before entering the fire boxes. The Nevadan and the Nebraskan are provided with oil tanks of 560 tons capacity, sufficient to take the steamers from San Francisco to Honolulu and back again and leave 800 or 900 bbls. in the tanks at the end of the trip. On the last trip of the Nevadan to Honolulu, which was begun at San Francisco on Oct. 9, and terminated on Oct. 16, Mr. Lassoe said:

"The results were better than were expected. The boilers and engines were worked to their full capacity. Not a burner was stopped througout the trip. The steam was kept at 200 lbs., with no variation of more than a pound or two. Ordinarily there was not the least sign of smoke from the stack. The boilers developed 2,500 H. P. Only 1.22 lbs. of oil were used per indicated horse power. The consumption was 3,006 lbs., or 9¼ bbls of oil an hour. The time of the trip was 7 days and 3 hours, and the average hourly speed was 12.3 knots. Running with coal we would have made one knot less speed. The advantage of oil over coal, as indicated by our experience, is that 20 per cent. more power can be obtained from the same boilers. Not only this, but the pressure is maintained at the same point. There is a reduction in the cost for labor in the fire room. We save twelve men. Instead of nine firemen we use three, and are obliged to have no coal passers, of whom we should require six if using coal. On the return trip the engineer was directed to run at a speed of 10 knots an hour as an experiment. The steamer left Honolulu on Oct. 27 and arrived in San Francisco on Nov. 4. The speed was 10.54 knots an hour. The burners worked with the same success as on the outward trip. The amount of oil burned was 1,390 bbls., or 7.2 per hour. This was 191 bbls. less than on the outward trip. The horse power developed was 1,834. The amount of oil burned per indicated horse power was 1.27 lbs. While the difference in the quantity of oil used was 191 bbls., it cost a day's time. Apparently it is more economical to use the maximum power of the boilers and engines. We have found that a pound of oil will evaporate from 14 to 15 pounds of water, while a pound of coal will evaporate only from 9 to 9¼ lbs."

Speaking of the future of oil as a fuel for steamships, he said that he thought it was better adapted to fast passenger steamers than to freighters, and that he looked for its development in that direction. "I think," said he, "that oil will be used in two years on such steamers as the Deutschland, the Lucania and the Kronprinz Wilhelm. Oil will give 20 per cent. more power from the same boiler plant, will reduce the fire room force on such steamers from sixty to eighty firemen and forty coal passers, will give a more even pressure of steam, and evaporate 75 per cent. more water per pound of fuel."

The American-Hawaiian Steamship Co. is contemplating the establishment of an oil storage plant at St. Thomas, where its vessels may stop for fuel on their way to and from San Francisco. The oil would be transported to St. Thomas directly from Texas. It has been found that, while the specific gravity of oil is lighter than that of coal, a ton occupying from 34 to 35 cu. ft. of space, it stows so much better that from 15 to 20 per cent. more oil than coal can be stowed in a given space.

DESIGN OF NEW BRITISH SCOUTS.

The new scouts of which four have been ordered for the British navy are to be about 360 ft. in length with a displacement somewhat under 3,000 tons. They are not intended to be improvements of the destroyer class but have a separate and distinct function, being primarily intended for use as the eyes of the fleet which they accompany. At the same time they are sufficiently armed to put any destroyer which crosses their path *hors de combat.* The comparative great length of these vessels, when combined with the long forecastle, will make them excellent sea boats, whilst the machinery being very much more strongly built than in the destroyer type, will enable them to keep up the guaranteed speed of 25 knots in any ordinary sea. The scantlings of the hull have been arranged to bear far greater strains than could possibly exist in any sea likely to be encountered, and there is a complete protective deck, carried from end to end, and sloped to below the water line all fore-and-aft; this deck varies in thickness from ⅝ in. to 1½ in. The coal carried in the normal condition is 165 tons, the full supply being about 580 tons, which, at a speed of 10 to 12 knots, will give a radius of action of about 3,000 miles. The boilers are of the small-tube Express type. The armament includes six 12-pounder quick-firing guns—two forward on the forecastle, two aft, and two amidships on the upper deck; eight 3-pounder quick-firing guns, four on each broadside on the upper deck; two 18-in. above-water torpedo tubes fitted on the upper deck, and training one on each broadside. Taken altogether, these vessels seem admirably adapted to the service intended, and in addition to acting as scouts, will minimize to a very large extent the danger to a fleet from a flotilla of hostile destroyers. The four vessels will be constructed—one each by Messrs. Vickers, Sons & Maxim, Ltd., Barrow-in-Furness; Sir W. G. Armstrong, Whitworth & Co., Ltd., Elswick; Messrs. Laird Brothers, Ltd., Birkenhead; and the Fairfield Co., Ltd., Glasgow.

DEATH OF MR. J. H. OUTHWAITE.

Mr. J. H. Outhwaite, for many years identified with iron mining in the Lake Superior country, died in New York on Saturday last as the result of an operation. He had for a number of years been a victim of ill health and had traveled a great deal in an endeavor to recuperate his physical forces. For the past ten years at least he had not been active in the management of his enterprises and about four years ago he took up his residence in New York. It may be said that he inherited iron mining as a life vocation. His father was one of the pioneers in the Lake Superior iron country, going to the Marquette range in 1848 and serving his time as mining agent when there were practically no vessels plying on Lake Superior and no railways whatever in the peninsula. Mr. Outhwaite, the elder, assisted in the construction of the first plank road that was built in the peninsula. Therefore as a boy trotting around with his father Mr. Outhwaite became familiar with the iron country. One of the earliest discoveries on the Menominee range was the Curry mine, which was located by Mr. S. S. Curry. Mr. Outhwaite in striking out for himself bought this mine from Mr. Curry and it proved to be a most profitable investment, for it laid the foundation of his fortune. Later he acquired the Sterling mine on the Marquette range and also became a large stockholder in the Pittsburg & Lake Angeline company. He was secretary and treasurer of the Pittsburg & Lake Angeline Iron Co., controlling one of the most remarkable mines on the Marquette range. Mr. Outhwaite was of a most genial and loveable nature and was deeply respected by all who knew him. He was about fifty-two years old. His widow and a son and daughter, Leonard and Marguerite, survive him. The remains will be interred at Lake View cemetery in Cleveland.

The Pittsburg Steamship Co. voluntarily decided to raise the pay of firemen, oilers, watertenders and handy men to $60 per month, beginning Nov. 10. Second cooks on steamers are to be paid $1.25 per day, the same as deck hands. When the last schedule of wages was adopted, which was Oct. 1, the wages of the firemen, oilers and watertenders were advanced $7.50 a month and the men agreed to work during the balance of the season at $52.50. The same proposition was made to the seamen, watchmen and lookouts, and although they accepted the advance they would not enter into an agreement for the balance of the season, and on Nov. 1 they demanded an advance to $60 a month, which was granted. This latest move is made to equalize the wages of all.

SHIPS AND SHIPPING IN SCOTLAND.

Glasgow, Nov. 10.—No improvements can be reported in ship building from the standpoint of future business. The ship yards appear to be well employed but as contracts are being worked through month by month the staffs are being diminished. There is as yet no proposal to reduce ship yard wages here, nor are the employers anxious to reduce. They would much rather keep up rates if the men would make a better output and take fewer off-days. But the wage question and the general conditions of work will probably come up for revision soon after the new year. In the meantime ship builders here are allowing those in the north of England, where trade is considerably worse, to negotiate reductions in their own locality.

Within the last few days more orders have been received from the United States for pig iron and a good deal of tonnage will be required between now and the end of the year to take away from Glasgow, Cleveland and Cumberland all that has been bought. But what the steamers which take it out are to get home again is another question. Meanwhile our finished iron and steel markets are quiet. The sensation of the moment is an amalgamation between A. & J. Stewart & Menzies, Ltd., Glasgow—the oldest and largest tube makers in Scotland—with Lloyd & Lloyd, Ltd., one of the largest tube concerns in the midlands of England. The capital involved is about $10,000,000.

In Belfast both Harland & Wolff and Workman, Clark & Co. are full of work. This week Harland & Wolff have booked orders from the Morgan combine, with which they are so closely associated, for three new boats of 12,000 tons each to run under the flag of the Atlantic Transport Co. between London and New York. They are to be named the Minnewaska, the Minnelora and the Minnehakta. The Leyland steamers are, it is said, to continue the service between Manchester and Boston. More boats will have to be built for the combine within the near future, but in the meantime these orders, with what they have on hand already will keep the Harland & Wolff yard in a state of bustle that other builders will regard with a considerable amount of envy.

SHIP BUILDING RETURNS.

The work done by Scotch ship builders in October aggregated twenty-seven vessels of 49,699 tons put into the water. This compares with thirty-three vessels of 57,800 tons in September last, and with twenty-seven vessels and 48,139 tons in October, 1901. The close comparison between the output of the two Octobers is remarkable. Of last month's total, 44,162 tons were launched on the Clyde, 1,600 tons on the Tay and 3,937 tons on the Dee. It included a 6,800-ton steamer built by Denny for the Australasian United Steam Navigation Co.; a 6,000-ton boat built by Charles Connell & Co. for the Asiatic Steam Navigation Co.; a 5,300-ton cargo boat built by Robert Duncan & Co. for Liverpool owners; a 4,700-ton boat built by Napier & Miller for the Mogul Co.; a 4,000-ton boat built by Scott & Co. for the British India Co.; a 4,000-ton cargo boat built by Russell & Co. for Newcastle owners; a 4,000-ton cargo boat built by Russell & Co. for Glasgow owners; a 2,800-ton boat built by Barclay, Curle & Co. for the West India and Clyde trade; a 1,000-ton cable steamer built by Fleming & Ferguson for the Canadian government; and a few more. Some four or five of the steamers may be called of the "tramp" order, which were contracted for when the future of shipping looked reasonably promising. All the rest were "liners" and specials. Then there was a sailing vessel of 2,000 tons built by A. MacMillan & Son for Aberdeen owners; the turbine yacht Emerald which I have already described; and a number of steam fishing vessels, dredgers, tugs and barges. With the exception of 1,800 tons or so, for Holland (a steamer built by Gourlay Bros. & Co., Dundee, for the Netherlands India Steamship Co.) and 1,000 tons for Canada, all the new tonnage was for British owners.

The total output for the ten months ending October is 446,270 tons. This compares with 443,565 tons up to the same date last year, and is the largest ten months' total on record. The October output alone was beaten in 1898 by 62,435, but with that exception also is a record. In the ten months the total output of the United Kingdom has been 503 vessels of 1,151,200 tons.

The new Scotch contracts booked in October would not exceed over 30,000 tons. It was reported that Caird & Co. had booked an order for two very large Peninsular & Oriental steamers, but this has been contradicted by the builders who have on hand two steamers for that company, the orders for which were received several months ago. The October contracts included an admiralty "scout," to be built by the Fairfield Co.; two boats of 6,000 tons each and one of 2,000 tons to be built by Barclay, Curle & Co. for the Union-Castle (South African) Line; another cable steamer for the West Indies & Panama Co., to be built by Napier & Miller, and some other craft for miscellaneous service. I do not think the list includes a single "tramp" steamer.

UP-TO-DATE CABLE-LAYING STEAMER.

One of the most interesting of recent events here has been the trial of the twin-screw cable-laying steamer Iris, built for the Pacific cable board of London by Messrs. David J. Dunlop & Co., Port Glasgow. The first day was devoted to the builders' progressive and maneuvering trials, and the second day to the official trials for speed under the conditions required by the contract. The principal dimensions of the Iris are: Length on water line, 285 ft.; breadth, molded, 40½ ft.; depth, molded to spar deck, 25 ft. The promenade deck extends for 109 ft. in midships, on which is placed the dining saloon and captain's room, and above this deck again is a boat deck, which forms an awning deck all over the promenade deck, and on this deck are located chart room and wheel house and state rooms for the junior officers. The electricians, cable officers, engineers, etc., have their apartments on the spar deck. The quarters for cable hands, crew, etc., are all on the main deck, and as the steamer is to be engaged both in hot and cold climates the fullest provision has been made for ventilation and the heating of all the apartments throughout the vessel by steam. The vessel has been fitted with four cable tanks—two forward and two aft of the machinery space. The cable machinery consists of very heavy gear forward and a lighter gear aft, suitable for paying out and picking up purposes. This gear is supplied by the Telegraph Construction & Maintenance Co., Ltd., of Greenwich. The various tanks in the double bottom have been so arranged that they may be used either as ballast tanks, or when in long service they may be filled with fresh water for the use of the boilers, etc. The deck machinery and outfit includes Napier Brothers' steam capstan windlass, Brown Brothers' patent telemotor and steering tiller, Lynn's steam winches, complete installation of electric light, including cargo clusters, with two engines, and coupled direct to two dynamos; Hall's patent anhydride refrigerating apparatus, capable of efficiently cooling meat and vegetable rooms, etc., having a capacity of 1,500 cu. ft.; docking, steering and engine room telegraphs, by Ray of Liverpool; loud sounding telephones to all parts of vessel; one steam launch, 30 ft. long; and five wood working boats. The propelling machinery which consists of two sets of triple-expansion engines, has been designed with a view to secure the least possible vibration, and has cylinders 18½, 31 and 51 ins. diameter by 39-in. stroke, with three single-ended boilers, 14 ft. diameter by 11½ ft. long, all proportioned for a working pressure of 190 lbs. to the square inch. The outfit of the engine room department includes Howden's system of forced draft, Weir's pumps, Davie's feed heater, Carruther's feed filters, etc., etc. On the progressive trials the mean of the full-speed runs made on the measured mile was 14.6 knots per hour, the maximum speed attained being 15.25 knots, while on the six hours' full-speed trial the mean speed over the distance ran was 14.4 knots per hour. During the trials the main engines worked throughout with the most perfect smoothness, while there was a total absence of any vibration on any part of the steamer, even when the fullest power was being developed. These speeds were nearly a knot in excess of the speed required by contract, which provided for a speed of 13¾ knots per hour with about 2,600 H. P., the vessel being loaded to a mean draught of 16 ft. The Iris is intended for the maintenance of the new cable which is now being laid, and will extend from Vancouver to Fanning island, Fiji, Australia and New Zealand, through which messages may be sent without touching on any foreign soil. It will be extended to the Cape of Good Hope and a loop will be formed to which all British possessions will be connected.

NEW ARMORED CRUISERS.

The specifications for the new first-class armored cruiser to be built by contract under this year's navy program have been sent out. The tenders are to be submitted to the admiralty by the middle of the month. Tenders are also asked for the machinery of a second vessel of the same class, to be built at Pembroke dock yard, to be named the Duke of Edinburgh. These vessels are to be about 13,000 tons displacement and will represent an entirely new type, being central-battery ships with all the big guns placed within a citadel, instead of each within a casemate, as in other cruisers. Several 9.2-in. weapons are to be fitted. The speed anticipated is 22 knots, which will necessitate machinery of between 23,000 and 24,000 I. H. P. The County, Devonshire and Drake cruisers were all designed to steam 23 knots. The new-type cruisers will be able to take their place against the new type high-speed battleships with only 10-in. guns. In the United States a controversy has taken place between the chief engineer of the navy and the chief constructor as to speed. The former prefers high speed for the new cruisers, indicating 23 knots as the irreducible minimum; whereas the chief constructor is of the same way of thinking as Mr. Watts, the director of naval construction for the British fleet, who desires great gun power and 22 knots. The United States naval engineer would, I understand, be satisfied with 22 knots if his weight allowances made it possible to give a large margin.

HOW MUCH WORK BEFORE LAUNCHING.

Opinions differ among ship builders as to how far a vessel ought to be completed before being launched. The construction of large cranes for lifting heavy weights on board while the vessel is on the building slip has no doubt encouraged extended operations before the flotation of the vessel. The results in the case of the French armored cruiser Kleber of 7,700 tons displacement are interesting. She was launched practically with steam up, and it was claimed that economy in time and cost resulted. But a subsequent minute examination of the structure has not caused much satisfaction. Important defects have been found. due to the operation of launching. The hull has been badly strained, owing to the uneven distribution of weights, and the engines and shafting are out of line. The vessel will, in fact,

require to be docked for thorough survey. Experts are aware that the form of a ship afloat differs from that of the vessel as she lies on the keel. In the case of a 11,000 to 12,000-ton cruiser recently launched it was found that the ends had dropped from the level line to the extent of practically an inch while a specially watched seam in the center of the ship had opened and subsequently closed to the extent of 1/5 inch during the period of launching.

Warship building being so much in evidence just now it may be of interest to give some notes from the programs of European nations. The French vote of 396,798,738 francs is about the same as in the current year; but there is economy in administration and a much-increased vote for ship building, especially in private yards. The Russian program includes a total expenditure of 104,417,791 roubles, more than in the current year, when a very good addition was made to expenditure. The ship building vote of £4,460,000 shows an augmentation of about £500,000 to carry forward the program of new ships, seven in the case of Russia. Of the smaller powers, Sweden proposes an armored cruiser, a sea-going torpedo boat destroyer, and three first-class and three second-class torpedo boats. The naval advisers of Sweden have put forward the view that the torpedo boat must be an important element in the defense of Sweden and Norway with their innumerable bays. Of Spain it is announced that the minister of marine has introduced a measure which embodies radical reforms in administration, and a new ship building program, including twelve large battleships and several high-speed cruisers The United States estimates amount to £16,485,300, which shows a considerable decrease.

An old and respected ship builder of the Clyde has passed to his rest this week in the person of Mr. William Simons, of William Simons & Co., Renfrew, near Glasgow. Following his father, who was a prominent ship builder in Greenock. Mr. William Simons obtained a practicay training in everything pertaining to ship building, and in 1860 he came to Renfrew as managing partner of works there. The excellence of the work turned out under his hands is proverbial, and amongst his own workmen the sharpness of his eye in detecting flaws was more feared than the inspector's visits. During his residence in Renfrew he took a prominent part in public affairs, and was for many years a much respected member of the town council. The question of dock accommodation was a point strongly advocated by Mr. Simons. Mr. Simons's health, unfortunately broke down about 16 years ago, and shortly afterwards he completely severed his connection with Renfrew and with business. The firm of William Simons & Co. have special renown as builders of dredges and special craft of a mechanical order.

The combine between John Brown & Co., ship builders and steel makers, Glasgow and Sheffield, and Thomas Firth & Sons, steel makers and gun manufacturers, Sheffield, is being completed this week. The Brown company take seven-eighths of the share capital of the Firth company and give in exchange 90,000 of their own ordinary £1 shares and 24,000 of their preference £10 shares. The organization will be a very complete one for the building and arming of warships and high-class vessels.

NAVY IS SHORT OF OFFICERS.

Rear Admiral Henry C. Taylor, chief of the navigation bureau, in his first annual report presents an argument for an immediate increase in the number of line officers in the navy, to remedy a condition of affairs unparalleled in the history of the service and which cannot continue much longer, he declares, without the efficiency of the navy becoming affected. The need of officers, it seems, has made itself felt with increased force during the last vear, and Admiral Taylor says that if the government were suddenly called upon to man for war service all the vessels available it would be confronted with requirements impossible to meet. The mobilization of the great fleet for the West Indies maneuvers is pointed out by Admiral Taylor as having brought this question to the fore. This condition, he says, is not due to any large number of officers being attached to ships now in service, but, on the contrary, he shows that United States vessels carry fewer officers than vessels of other navies.

Admiral Taylor says that as the navy is unable to draw men from the small vessels of the merchant marine and as the number of ships is increasing a large number of officers is required to drill recruits. To this end he presents the following table showing the number of line officers, including midshipmen after graduation, now required by the navy:

Total number of line officers, including midshipmen after graduation, required for vessels now, on navy list	1,206
For navy yard, inspection and court-martial duty, naval academy, recruiting, ordnance, equipment and engineering	264
In transit to and from stations	70
Total	1,540
Two per cent. sick	30
Two per cent. on leave or waiting orders	30
Total	1,600
Number on navy list, including midshipmen after graduation	1,023
Short	577

The minimum number of line officers required to man a battleship is: One commanding officer, one executive officer, one chief engineer, one navigating officer, six turret officers, two secondary battery officers, three power division officers, two assistants to chief engineer; seventeen in all, including midshipmen. In order to make plain that this is the lowest possible estimate of officers actually needed on board battleships there is furnished the following statement of the number of officers actually placed on board ships of similar displacement by foreign powers; England (Barfleur), including midshipmen, thirty-three; France, (Bouvet), including midshipmen, twenty-six; Germany, (Kaiser Friederich III), midshipmen not included, twenty.

"It will be seen at a glance," says Admiral Taylor in referring to this comparison, "that the estimate in the first case, which includes midshipmen, is at least 30 per cent. smaller than actual conditions now existing in other navies."

The following table shows the number of line officers thought to be absolutely necessary for vessels now authorized by congress, but not completed:

Maine	17	Des Moines	12
Georgia	17	Chattanooga	12
Pennsylvania	17	Tennessee	15
Rhode Island	17	Washington	15
Louisiana	17	Arkansas	7
California	15	Nevada	7
Nebraska	15	Wyoming	7
West Virginia	15	Paducah	7
Maryland.	15	Five submarines	5
Colorado	15	Cleveland	12
South Dakota	15	Galveston	12
Connecticut	17	Tacoma	12
Ohio	17	Florida	7
Virginia	17	Dubuque	7
Missouri	17	Thirteen destroyers	39
New Jersey	17	Seven torpedo boats	14
St. Louis	12		
Milwaukee	12		
Charleston	12	Total officers for which no provision is made.	498
Denver	12		

This number (498) does not include the 25 per cent. allowance for sick leave and shore duty. With these added the total would be 623. The probable graduates from the naval academy by the highest estimate will be as follows during the next four years:

1903	50	1906	140
1904	65		
1905	100	Total	355

Admiral Taylor says: "The casualties last year among the line officers of the service, other than cadets of the naval academy, were forty, which for the next four years, without an increase in the number of officers in the service, would make a total of 160, which, added to 623, would give a total of the needs of the service for the above vessels, as far as naval increase in personnel is concerned, of 783. This number added to 577, the shortage which exists at the present time, will give 1,360. The graduates expected from the naval academy being but 355 during the next four years, the total deficit July 1, 1906, will be 1,005. This does not provide for officers required for the auxiliaries that would be added to the list of naval vessels upon hostilities being declared; for these purposes there should be added at least 200 more."

It is recommended that the number of midshipmen at the naval academy be increased by allowing each senator and representative two appointments instead of one and a midshipman from the District of Columbia and ten annually at large. Admiral Taylor also recommends that provision be made for two vice-admirals on the active list for duty as flag officers of the North Atlantic and Asiatic stations, where the heavier fighting ships are stationed. He also asks for legislation for the establishment of a general staff with the control necessary to administer more efficiently the affairs of the fleet.

In the estimates for the next fiscal year $120,000 is asked for "gunnery exercises," which is ten times the usual amount, and Admiral Taylor asks that it be made immediately available, as pistol galleries are needed at all stations, rifle galleries at many others and ranges up to 1,000 yards at various points.

As a result of close study of naval affairs from a strategical standpoint the general board of the navy, of which Admiral Dewey is president, has decided upon an important plan for the division and distribution of the fleet. This plan, which will be carried into effect when the winter maneuvers in the West Indies are over, provides for the formation of two strong squadrons of armorclads, one for service in the far east and the other for service within the present limits of the North Atlantic squadron. All the available battleships will be withdrawn from the South Atlantic, the European and the Pacific stations and attached to one or the other of the squadrons to be strengthened. It is understood that the underlying motive of this new policy is the belief that in the event of hostilities between the United States and any foreign power the struggle will be mainly for the mastery of the Pacific, while it will be necessary to maintain a large force for home defense on the Atlantic coast.

The Shipping Combine.

FROM AN OCCASIONAL CORRESPONDENT.

The Morgan shipping combine is a scheme so great and so novel that it has attracted much attention on both sides of the Atlantic. What the combination is, what it is intended to accomplish and what its result upon both American and British shipping will be, are questions that are worthy of serious consideration, although they cannot be definitely answered until more detailed information is at our disposal.

The origin of the scheme is an agreement made on Feb. 4 of this year, between J. P. Morgan & Co., as purchasers, and five sets of vendors, representing respectively the White Star Line, the Dominion Line, the Atlantic Transport Line, the American Line and the Leland Line. The first-named was, at the time of the agreement, the property of a British corporation, the Oceanic Steam Navigation Co. The Dominion Line was also owned by a British company. The other three lines have been owned in the United States for some time past, the American Line, being, as is well known, the successor of the old Inman company. The ultimate object of the agreement was the acquisition by a new corporation, registered in New Jersey (the International Mercantile Marine Co.) of the lines named above. The mode of acquisition was substantially the same in every case. What the corporation was to acquire, and has now acquired, was, in the case of the White Star Line, all the shares of the Oceanic company, including all the new vessels in course of construction, and all rights in the name and flag. The same language is used in the case of the Dominion Line. In the agreement with two of the American-owned companies, what is acquired is the capital stock, properties and assets of the respective concerns, but in the purchase of the Leland Line, there is no mention of vessels, nor other assets, what is acquired being 58,703 preference shares and 18,463 ordinary shares. The agreement, however, notwithstanding minor variations, is substantially the same throughout. The New Jersey corporation becomes the owner of the stock of the various companies, carrying, as incident to such ownership, the control of the ships belonging to such companies. But the companies themselves do not lose their corporate identity, and the owners of the White Star Line have made much of this point, probably for good business reasons. The new company becomes simply the owner of all the shares in all the companies, and will, as a result of its ownership, direct and control the combined fleets. The flag of each company, whether British or American, will be the same as before, but an American corporation will own all the stock in all the companies. This stock will have a New York Stock Exchange quotation, and can, no doubt, be bought by anybody. The Leland Line, which was acquired by J. P. Morgan & Co. some two years ago, was to be paid for in cash, while the other properties were to be paid for partly in cash and partly in shares of the new corporation. A White Star stockholder has received, or is about to receive, ten times the value of his stock—or $50,000 in cash and stock for $5,000 worth of White Star stock. The purchase price of the White Star Line, remarkable as it may seem, was $53,491,180, of which $15,736,180 was payable in cash, $25,174,000 in preference shares and $12,587,000 in common stock. It is not unfair to say that the latter is not more valuable than is the common stock of the United States Steel Corporation, and that no investor would be wise in paying a higher price for the one than for the other.

A financial syndicate was formed in New York early in the year which was required to provide $50,000,000 in cash, and was to receive $27,500,000 in securities by way of remuneration.

Collateral to the main contract is a "builders' agreement" between J. P. Morgan & Co. and Harland & Wolff, ship builders of Belfast, Ireland, whereby the latter are to build all the ships for the British companies, but are not to build for any other ship owners, except the Hamburg-American company.

What is the constitution of the new corporation as regards American and British directors is not made quite plain, but there is little doubt that the controlling voice will be on this side of the Atlantic.

Side by side with this Anglo-American agreement, there exists another agreement between J. P. Morgan & Co. on behalf of the same syndicate, and the two great German companies—the North German Lloyd and the Hamburg-American. The chief feature of the British agreement is entirely absent here. There is no merger of corporate existence, no purchase of shares, nothing but a working agreement. Care is taken that the control of the German companies shall be retained in German hands. The syndicate undertakes not to acquire shares in the German companies, either directly or indirectly, and in like manner the German companies agree to abstain from the direct or indirect acquisition of shares in the syndicate. The German companies undertake to pay to the syndicate a portion of their dividends corresponding to the ownership of the stock to the value of £1,000,000, and the syndicate undertakes to pay to the German companies interest at the rate of 6 per cent. on the same amount. The syndicate undertakes not to send any of its ships to a German port without the consent of the German companies, and the latter agree to observe certain restrictions in respect to their traffic with British ports. A committee of four, consisting of two representatives of the syndicate and two of the German companies, is to supervise the agreement. It has been asserted, probably with truth, that the German companies would willingly have entered the combine on the same terms as the American and British lines, but were precluded from so doing by their dependence on the subsidies of the German government. Such reference books as are obtainable in this country do not give the amount of these subsidies. The whole scheme of the Morgan combine, as far as it has been made public, may, therefore, be summed up in a single sentence. The International Mercantile Marine Co. will own all the shares, and all the ships of the combined companies, but will not own any part of the German companies, with which it will have a working agreement as to ports of call and ownership of stock.

In England the shipping combine has been represented as an audacious attempt of American capitalists to control a great part of the British mercantile marine. This idea is quite absurd. About 50 per cent. of the shipping of the world is done in British ships. The Morgan combine has acquired less than 5 per cent. of those ships. Mr. Pirrie of Harland & Wolff, one of the promoters of the combine, has said that "the combination was established purely for commercial purposes and on business principles." The vendors, without doubt, had reason to believe that they were making a good bargain for themselves. Whether they have done so or not, the future alone can determine, for they have been paid to a great extent in the stock of the new corporation. A White Star stockholder receives a considerable sum in cash, it is true, but, on the other hand, he has in the past received large dividends, which may justify the price now paid for the company. The old companies had to face the prospect of increased competition in a field in which competition was already keen. Rather than do this, they preferred to join their rivals in a coalition of the "trust" variety. As to the promoters, they must, of course, be credited with business motives of a very ordinary kind.

First, concerning fast steamers: As things have been in the past, two half empty steamers have left New York on the same day of the week, when, by a proper agreement, one steamer fully loaded with freight and passengers could do all that was necessary, thus saving much coal and a great amount of wear and tear. Secondly, the business necessities of the great railroads of this continent have made some kind of shipping combine a condition greatly to be desired, for the system under which each railroad made its own arrangements with the various steamship companies produced intolerable confusion in the handling of freight. When, some time ago a number of the roads pooled their interests and became "one association," the organization of sea traffic on lines corresponding with the organization of the land traffic became a business necessity. It was a vital matter for the associated railroads to be able "to direct the movements of freight steamers, to allot their ports and fix the dates of their sailing." Before the new scheme came into existence, the railroad interests had acquired the control of the American shipping now forming part of the combination. In addition, they could control some four-fifths of the ocean-going traffic, and they claim to own the docks, outside New York city, by which all the Atlantic passenger and freight steamers load and unload at all United States ports.

We are told that "the British ships in the combination will remain British." This brings us to the question: What is meant by a British ship? The answer to this question will show that there is, at present, nothing to prevent American capitalists owning British ships, flying the British flag, provided the nominal owner is a British corporation. It is true, of course, that the parliament of Great Britain can change this condition, but no such suggestion has yet been made. All British ships are, of course, under the control of the laws of the United Kingdom. A British ship is simply a ship owned entirely by British persons. If any other person acquires a share in a British ship, it loses its national character, and if the British national character is improperly assumed, the ship become subject to forfeiture. But "a person" in this case includes a corporation. The list of qualified persons includes any corporate body—that is, any incorporated company established under the laws of some part of the British dominions and having its chief place of business within those dominions. But by the law of Great Britain and her colonies, any individual of any nationality may own a share—or all the shares—in a British company, even if that company owns a British ship and nothing else. There is nothing to prevent that. Through the operation of the English law as to corporations, a British ship may be owned partially or predominently or even entirely by foreigners without losing the British national character or forfeiting its right to fly the British flag. The Atlantic Transport Line and the Leyland Line were undoubtedly owned by

Americans prior to the formation of the Morgan combine.

Nobody can say what number of ships flying the British flag is really owned by British subjects. It is possible, however, to give the ships under foreign flags owned in the United States at the end of last year. These were as follows:

	Number	Gross tonnage.
International Nav. Co. (Red Star Line)	15 ships.	100,259
Atlantic Transport Co.	17 ships.	123,593
Hogan & Co.	11 ships.	41,744
F. E. Bliss	8 ships.	30,602
Chesapeake & Ohio Ry.	6 ships.	20,279
W. R. Grace & Co.	5 ships.	16,499
United Fruit Co.	2 ships.	3,219
Fredk. Leyland & Co.	21 ships.	43,865

To ascertain what number of ships is owned by British incorporated companies would probably be an easy matter. but that point does not effect the combine at all, and what is most worthy of consideration, therefore, is the possibility of British legislation injurious to the interests of foreign owners of ships flying the British flag. As the United States law at present stands, a foreign-built ship cannot fly the stars and stripes, so that, without special legislation, the vessels of the International Mercantile Marine Co., which have been constructed in Europe, cannot be given American registration.

The exact position of affairs can best be understood by looking at the facts from the British point of view. The protection of British ships is, of course, a duty of the British navy, and that navy must protect all ships registered as British, whether the stockholders in the companies owning them are foreigners or not. This may lead to curious complications in time of war, and had the combine owned the White Star Line prior to the ending of the South African war, some American-owned ships would have been engaged in the transportation of British troops to the Cape, although the sympathy of many Americans—possibly some of the stockholders—was with the enemies of Great Britain.

The navy, besides being the protector of British shipping, looks to the mercantile marine for support in more ways than one. Certain ships have been retained for use in time of war. In 1885 the British government was compelled to expend about £600,000 in retaining the services of fast steamships in order to prevent their being available for the use of another European nation. An arrangement was therefore made by which the admiralty would be able to avoid a repetition of this extraordinary expenditure, and at the same time retain at its disposal a fleet of armored cruisers. A contract was entered into with four steamship companies for the payment of a fixed sum per ton per annum on account of certain steamers built in accordance with plans approved by the admiralty, these steamers to be held at the disposal of the admiralty as cruisers in case of war. The amounts payable vary according to the average continuous speed of the vessel, the highest sum obtainable being £10,000 per annum in the case of a ship capable of maintaining a continuous speed of 21 knots per hour. The payment is subject to a reduction of 25 per cent. in the case of a vessel having a mail contract, as well as a further reduction if the stipulated number of naval reserve men are not carried. The total payment to all four companies for the retention of some forty ships has been about £70,000 per annum. Of the companies in the combine the only one which received any part of this payment was the White Star, which, as everybody knows, also receives remuneration from the British government for carrying mail between Queenstown and New York. The Dominion company may have a mail contract, but nothing more, and if such contract exists it is for the conveyance of mail to Canada. So that, for practical purposes the relations between the British government and the companies in the shipping combine are almost limited to the White Star Line. Great Britain pays large sums to men and officers of the mercantile marine on condition of their qualifying themselves by training for naval service and holding themselves available for such service in time of war. The assumption has been, both in the case of the payments for the ships and the remuneration to the men, that the British government was dealing with British ships and with British seamen. This is no longer the exact condition. It now appears, however, that the admiralty has renewed its three years' agreement with the White Star Line, making provision that during the term there should be no transfer of the ships to a foreign flag. This would imply that the transfer of all the shares in the company to a corporation owned by Americans is not a matter of importance. Mr. Morgan seems to have offered to place all the British ships in the combine, as well as all British ships to be built in the future, under the British flag for fifty years, which means that they would be nominally owned by a British corporation, and would be at the disposal of the British admiralty. Had this offer been accepted, neither American subsidies nor an act of congress could have accomplished their transfer to the stars and stripes for many years.

A new factor in this question has now appeared on the scene. Until very recently British subsidies to shipping were, in reality, limited to the £70,000 already named, although, of course, there were payments for carrying mails to all parts of the world. In this trade less than 500 ships have been employed, so that 95 per cent. of British ships have received no payment whatever from the government. Since 1860 British mail contracts have been under the control of the post office department, and this department has been required to advertise for bids for the conveyance of mails, and to award the contracts to the lowest responsible bidders, regardless of nationality. In 1886 a foreign company (North German Lloyd) held a contract for the conveyance of letters between Southampton and New York, and if similar contracts have seldom been awarded to foreign companies it has been because their bids were not sufficiently low. The total sum paid by Great Britain in the past for the carriage of mails to all the world has not exceeded £750,000 per annum.

The United States have adopted a different policy. For the conveyance of European mails the American line receives by contract $4 per statute mile; a non-contract American company would receive $1.60 per pound and foreign companies receive about 45 cents per pound.

The new factor in the question is the departure of Great Britain from its traditional policy which has existed for more than forty years. The Cunard company is now to receive an annual payment of about $750,000, and the government is to loan to it at 2¾ per cent. interest a sufficient sum to build two fast steamers, the amount to be repaid in annual instalments extending over twenty years. The company is to remain British, and it undertakes not to unduly raise freight rates. The Cunard corporation has been well paid for remaining outside the combine, and its annual subsidy is now equal to that received each year by the American line from the United States government. If the railroads of this country discriminate against the Cunarders in the loading or unloading of freight in any manner which is considered unfair, there is very little doubt that British legislation unfavorable to the combine will be enacted. The mere preference of the ships of the latter and the making of through rates will not, of course, be regarded as anything beyond fair competition.

Looking at the position of affairs as it now is, the British government is asking itself certain questions. First, is a question that refers to a very large number of corporations outside the shipping trade: Is it desirable to legislate, if possible, with the object of preventing or regulating combinations of capital on a gigantic scale?

Is it desirable to endeavor by public action to strengthen British shipping against foreign competition? Apart from all necessary payments for mail services or naval services, is the policy which has been adopted in the case of the Cunard company to be repeated in the case of other companies upon the ground that other nations pay subsidies to steamships which compete with those owned in the United Kingdom?

Is it justifiable to discriminate between British and foreign ships, so long as the former are owned so extensively by companies, and so long as such companies may be made up wholly or partially of foreigners? Is it reasonable that a ship should be debarred from flying the British flag because some very small share is owned by an alien, while a sister ship may fly the flag although the company owning her has no British stockholder on its list?

Is it right that the British government should retain for service as cruisers in time of war, and for carrying its naval reserve men in time of peace, ships owned by corporations whose stockholders are non-British? As long as the admiralty can make sure of securing both ships and men when needed, does it matter what flag the ships carry as merchant vessels, seeing that the flag is not a true guide to their national character?

Is the merchant cruiser system as adopted by Germany, the United States and the United Kingdom altogether satisfactory? Is it desirable that during a war the fastest merchant ships should be withdrawn from their proper business of carrying freight and passengers? Would it not be better for the governments concerned to build all the cruisers needed at their own cost?

The answers to these questions cannot be delayed very long, and they may be of a character which is little expected. One reply may possibly take the form of "British ownership must be real, not nominal, otherwise the use of the British flag is forbidden." The absence of any specific answer to Mr. Morgan's offer, mentioned above, would indicate that such a regulation is not outside the region of practical politics. The replies to the other questions may be on similar lines, and if so, the combine will have some hard nuts to crack. Nor is this all. Certain British merchants have already informed their American representatives that all goods shipped to them from the United States must be marked "via Cunard," and that all goods from Canada must be carried by the Allan Line, which is outside the combine. How far this policy may extend, no man can tell. At present, however, its influence will be extremely small. The Canadian Pacific railway is about to start a transatlantic freight service, which brings one more competitor into the field.

The new steam pilot boat New Jersey, built by Brown & Sons, Tottenville, for the New York, New Jersey & Sandy Hook Pilots' Association, underwent a successful trial trip last week. The New Jersey is constructed of wood. She is 159-ft. over all, 157-ft. keel, 28-ft. beam and draws 12-ft. of water. She is equipped with a triple-expansion engine.

NEWS OF THE GREAT LAKES

GOVERNMENT IMPROVEMENTS AT LAKE ERIE PORTS.

Maj. Dan C. Kingman, government engineer at Cleveland, is at present superintending work in his district involving the expenditure of millions of dollars. The district embraces all the Lake Erie ports in Ohio. At Toledo contractors are dredging a straight cnannel 400 ft. wide and 21 ft. deep, extending 8 miles through Maumee bay and 7 miles along the river front. Part of this work has been completed and there is noted a gratifying increase in tonnage thereby. At Port Clinton, which does a small fruit trade, $5,000 is being expended in dredging between the piers to a depth of 12½ ft. At Sandusky $75,000 is being expended in making a 21-ft. channel along the city front. At Huron $10,000 is being expended in rebuilding the west jetties which are to be made 500 ft. long. A survey is also being made and plans prepared for a 21-ft. harbor. At Vermillion the shore end of jetties are being repaired but there is no appropriation for this purpose. At Lorain $490,000 is being expended in rebuilding piers and jetties and removing the east pier a considerable distance eastward. At Rocky river a survey has been authorized and preliminary examination made. At Cleveland work is continuing for rebuilding the superstructure of the west breakwater. L. P. & J. A. Smith are dredging a channel from the Lake Shore bridge to the outer harbor for a depth of 25 ft. This is the first harbor to be given a depth of 25 ft., the maximum in other harbors being 21 ft. L. P. & J. A. Smith have also just been awarded a contract for enlarging the main entrance of the Cleveland harbor. This improvement consists of extending arms out into the lake 1,250 ft. beyond the present breakwater and having them converge to within 700 ft. of each other. These arms join the present breakwater at about 500 ft. from the mouth of the river. The present space between the east and west breakwaters is 500 ft. so that 200 ft. of the east breakwater will be removed in order to have it correspond to the width of the converging arms which will make the real mouth of the harbor. Hughes Bros. & Bangs of Syracuse, N. Y., have been awarded the contract for extending the east breakwater a distance of 10,000 ft. These two improvements—the harbor entrance and the extension of the east breakwater—call for an expenditure of approximately $2,800,000. Maj. Kingman is preparing to repair by hired labor 1,200 ft. of the east breakwater, the surface of which is considerably decayed. At Fairport the Donnelly Contracting Co. of Buffalo, has been given the contract for rebuilding the greater portion of piers and putting concrete on the superstructure at a cost of $150,000. At Ashtabula the Donnelly Contracting Co. has also been given the contract for building the two detached piers, one 1,200 ft. long and the other 1,800 ft. long. At Conneaut the same company is also repairing, rebuilding and extending the piers, putting on concrete tops and finishing the west breakwater, and building 750 ft. on the east breakwater at a cost of $450,000.

NEW HYDRAULIC DREDGE FOR L. P. & J. A. SMITH.

L. P. & J. A. Smith of Cleveland have just given an order for a new dredge. Owing to the fact that it is intended primarily for use in Buffalo harbor it will be put together in that city. Buffalo harbor is usually the last harbor to open, and unless the dredge was built there it might be impossible to take it there when it was needed owing to the ice. The dimensions of the dredge are: Length, 120 ft.; beam, 40 ft.; depth, 12 ft. The hull will be of steel and will be built by the Forest City Boiler Works of Cleveland. A triple-expansion engine with cylinders of 17, 27, 45 in. diameter and stroke of 24 in., will be supplied by the Great Lakes Engineering works of Detroit, to operate a 24-in. suction pump, which will also be supplied by the Detroit works. A Scotch boiler 13 ft. in diameter and 12 ft. long will be supplied by the Lake Erie Boiler Works of Buffalo, N. Y. The dredge will be lighted by electricity and the cutter head at the base of the 24-in. pipe will be operated by a 150-H. P. motor. The dredge will not be self-propelling. Its approximate cost will be $100,000, and it is expected to go into commission next April. The entire work of assembly will be done at the Lake Erie Boiler Works.

CROWDED SITUATION AT BUFFALO.

Buffalo, Nov. 19.—It has come rather later than usual in recent years but the regular fall Buffalo grain blockade is in evidence. In a few days it will be more noticeable and will get worse and worse until the close of navigation. There is so little time remaining before the close of canal navigation that but little relief can be afforded by the Erie canal, and the car shortage is greater than ever before. That a serious blockade has not existed for some time past is entirely due to the fact that grain receipts at this point have been unusually light.

One of the vessel men who keeps well posted regarding elevator matters at this point says: "I have been advising my friends among the vessel owners to be very careful about charters involving winter storage. It would not be surprising to learn of an effort to collect storage on the grain from vessels lying at the elevators. Of course if the grain is to be stored all winter the vessel could tie up almost anywhere in or around Buffalo harbor without more than the usual expense, but if she had to pay storage for lying at a particular elevator where part of her cargo was to be unloaded during the winter, or pay tow bills to and from such elevator, it would be quite a different matter. Of course this is a question to be settled in advance of charter."

NOT A VERY PROFITABLE SEASON.

The closing of navigation on the great lakes for the present season is to be very tame. No advanced freights are expected, and if mild weather continues into December the ore shippers will probably have no difficulty in fully carrying out their plans for the closing part of the season. The vessels as a whole will not show earnings equal to last year. Profits will be confined to vessels of the larger type and there will be no big earnings in any branch of the trade. There has been none of the 3-cent grain of 1901 and no high rates on final trips with ore to make an average against low summer rates, while the delays at unloading ports have been worse than in any past year and operating expenses have steadily increased. It is not probable, therefore, that any talk of contracts for 1903 will contemplate a lower basis of rates than those prevailing in the present season. If anything lower is proposed, contracting for another season will certainly be very much delayed. From present indications it would seem that 1903 will be another big year in ore and the shortage of coal in the northwest will be so great when the present season closes that next year should see the greatest movement of coal ever known.

TANKER TOLEDO AT KINGSTON.

Kingston, Ont., Nov. 19.—The oil tank steamer Toledo, built by the Craig Ship Building Co. of Toledo, is in the government dry dock getting a few repairs before proceeding to the coast. On board is Mr. Edward Gaskin, who has represented the owners—Sun Oil Co. of Pittsburg—in the construction of the vessel, and who was for a long time in charge of the Union Dry Dock Co.'s works at Buffalo. On board also is Capt. M. W. Humphrey of Detroit, who is taking the vessel through the St. Lawrence canals. Later on, the captain who is to be permanently in charge of the vessel, Mr. H. Ockleman of Philadelphia, will take charge. He has long been in the company's employ. The tanker, now drawing 14 ft. of water, will lighten considerably before proceeding through the canals.

AROUND THE GREAT LAKES.

Joseph Selwood and Richard N. Selwood are interested in the La Rue Mining Co., organized at Duluth recently with $1,000,000 capital.

A new ship building industry for Toronto has been incorporated with $1,000,000 capital, called the Canadian Ship Building Co., with George A. Cox, William MacKenzie, Frederick Nichols, W. R. Brock and W. D. Mathews as provisional directors.

Capt. John Griffin, who commanded the schooner Ishpeming during the past summer, died at the Toledo hospital Sunday. He formerly owned the schooner St. Peter, and was the only survivor among those on board when that vessel foundered three years ago on Lake Ontario.

The Manitowoc Dry Dock Co. has taken a contract to build for L. A. Cartier and others of Ashland, a small passenger steamer for the freight and passenger trade out of Ashland. The cost is approximately $30,000 and delivery is to be made with the opening of navigation. The vessel will be 115 ft. over all, 22-ft. beam and 7½-ft. deep.

Waukegan's importance as a coal receiving port is to be greatly increased next year through extensive work to be started by the Western Coal & Dock Co. of Chicago. Additional docks and hoisting apparatus will be built. It is reported that the capacity of the docks will be increased from 100,000 to 500,000 tons per year.

A rumor, very probably well grounded, is to the effect that the operating department of the Pittsburg Steamship Co., (Steel Corporation fleet), will entirely moved to Duluth after the close of the present season of navigation. No matter what else may be done in this regard, it is said that Chief Engineer Hayes will join General Manager Wolvin at Duluth.

Capt. Lansing H. Beach, lighthouse engineer at Detroit, is about to ask for an appropriation for a powerful tug to be stationed at Sand Beach harbor of refuge to assist steamers with tows to safety through the uncertain cross currents which prevail there during stormy weather. During October 300 vessels sought shelter there.

Capt. D. D. Gaillard, United States engineer in charge of Lake Superior, announces that plans are now being prepared for the improvement of the harbor of Port Wing. Private property owners have dedicated the ground necessary for the piers and the government has appropriated $50,000 with which to construct them. Port Wing is thirty-five miles from Duluth.

About 4,000,000 tons of ore will be shipped this season from the Great Northern docks on Allouez bay, Superior. The management is figuring on shipping 6,000,000 tons next year. The increase in the ore business of this road has been wonderful. In order to take care of the increase in shipments planned for next year a third shipping dock of 160 pockets and 45,000 tons capacity is to be built during the winter.

Before giving an order, some time ago, to the Jenks Ship Building Co. of Port Huron for the wrecking lighter Thomas F. Newman, officials of the Great Lakes Towing Co. were figuring on two such vessels. The success of the Newman in the vicinity of Detroit prompts the opinion that a similar vessel would find considerable to do on the St. Mary's river. A duplicate of the Newman will very probably be built but not for some time to come.

The Inland Lakes Transportation Co. has been incorporated with a capital of $1,000,000 to put a new line of steel steamers on the route between Georgian bay and Lake Superior ports. The head office is in Collinwood and the directors include J. J. Daley and Michael Straus, Chicago; F. A. Bassett and A. A. Bond, Collinwood; Henry Pedwell, Thornburg, Ont.; James Murphy, Meaford, Ont.; F. V. Clisdell, J. R. Bond and J. W. Curry, Toronto.

Capt. J. M. Field, who is now well known among compass adjusters of the lakes, and who is the maker of the Field's reversible compass and course corrector, has gone to his home in California for the winter but will be back again early next spring. Capt. Field's San Francisco address is 857 Howard street. His compass corrector has met with very large sale on the lakes this season. It was placed aboard all the vessels of the Steel Corporation and is highly recommended by Capt. W. W. Smith, who is in charge of that fleet.

W. J. Farasey, Cleveland steamboat agent, announces that all freight received by the Rutland Transit Co. at Cleveland after Nov. 17 for Chicago, Milwaukee and points west thereof, for the present season, will be subject to all-rail rate providing the Rutland company is unable to move it. Mr. Farasey also announces that freight will be received by the Lackawanna Green Bay Line at Cleveland up to and including Wednesday, Nov. 26; after that date freight will be subject to all-rail rate, providing the company is unable to move it.

Milwaukee's receipts of soft coal by lake to Nov. 1 aggregated 954,000 tons, or 338,000 tons more than on the same date a year ago, and yet there is much less coal on hand at that point than in any previous year. Milwaukee is the one point from which coal is distributed to the northwest that was favored by fairly large shipments from Ohio ports early this season. Reports of this kind indicate a very heavy shortage in coal throughout the northwest with the close of navigation and consequent heavy shipments next season if the railways are able to take care of the business.

It is the general opinion in lake vessel circles that a very strong steel combination will result from efforts now being made to unite the Jones & Laughlins, Union Steel and Sharon Steel interests. These are among the largest and most substantial of the steel companies outside of the big corporation. They control raw materials on a large scale and are known as big, conservative organizations—not public stock concerns. It is said that the effort to unite them contemplates a capital basis fully as conservative as that of the three companies themselves, and that it is this combination, if effected, that will control a new railway from Lake Erie to the Pittsburg district.

The steamer Robert Wallace foundered on Lake Superior last Monday night. The Wallace, towing the Ashland, both laden with iron ore, left Superior for Cleveland. When 13 miles south by east from Two Harbors the stern pipe of the steamer was broken, water at once beginning to pour into the hold. The crew, perceiving that the ship was doomed took to the lifeboats and reached the Ashland without mishap. The Ashland burned distress signals which were responded to by the tug Edna G., which towed the vessel into port. A long search was made for the abandoned steamer but no trace could be found of her. The Wallace was built in 1882. She measured 1,189 tons and was valued at $40,000.

The tank steamer Toledo, built to engage in Texas oil trade for the Sun Oil Co. of Pittsburg, and now on her way down the St. Lawrence to the Atlantic, is the ninth vessel for salt-water service built by the Craig Ship Building Co. of Toledo. Two or three of them are on the Pacific. All have been successful ships, due no doubt to careful attention to certain details in ocean-going craft that are not required on the lakes. Probably some of Capt. John Craig's friends do not know that his original training, although he came to the lakes years ago to build wooden ships, was in the Atlantic coast yards in and around New York. He is all the time in touch with what is going on at the Toledo works, but manages, nevertheless, to very often visit Atlantic coast shipping districts and occasionally those of the Pacific. The Toledo yard is not one of great magnitude but it has been highly successful and there is no wonder on that score from the vessel men of the lakes who know of Capt. John Craig's shrewd business characteristics.

On the lakes, where decks of ships in the iron ore, coal and grain trades are almost open space on account of the way in which they are cut up into hatches to facilitate the handling of cargo, numerous attempts have been made to design a steel cover, a secure, tight structure, that would take the place of the plank and tarpaulins with which the big open deck spaces are generally covered. No steel cover as yet designed has been accepted by ship builders or ship owners. There is certainly a demand for the right kind of steel hatch cover. Any design must, of course, have merit as to least possible weight and facility in handling. Capt. W. W. Dawley of the Wilson Line steamer Henry W. Oliver, has been experimenting this season with a steel hatch cover, in which he has a great deal of confidence and to which he will direct special attention during the coming winter. A cover of his design is now being used on one hatch of his vessel. Capt. Ed. Morton, who is in charge of the Wilson fleet, thinks well of it. The cover is in one piece, is attached by hinges to the hatch on the after side and is raised and lowered by hand gear.

OCEAN-GOING LIGHTERS.

The importance acquired within the last few years by the ocean-going lighter is the subject of an article in a Belgian paper from the pen of M. Dufourny, president of the Belgian Society of Engineers and director of roads and bridges. The writer divides the lighters into two classes—first, those which ply exclusively in salt water from port to port, going for example from England to the continent, crossing the English channel, the North sea and even the Baltic, and secondly, those which not only navigate the ocean but proceed, in some cases for long distances up the rivers and along the inland canals. Lighters of this last-mentioned kind go up the Rhine as far as Cologne, and ascend the Weser as far as Bremen, and the Elbe beyond Hamburg. Some of them even find their way to inland ports on the canal between Dortmund and the Ems, whence they fetch coal, coke, rails and phosphates, and return laden with corn, timber, ore and colonial produce. The size of the sea-going lighters is increasing, and is likely to still further increase. The Unterweser company possesses some of 1,250 tons register, and the Hamburg companies have a number of similar dimensions. But new ones of still greater tonnage are now in course of construction. The statistics of the North sea and Baltic canal show that lighters of between 750 and 1,000 tons are the kind which have increased the most in recent years, and the extent to which lighter navigation has developed is indicated by the fact that in 1899 the total capacity of the lighters measuring between 750 and 1,000 tons which passed through that canal was 8,027 registered tons, while in 1900 it was 14,207 registered tons, or an increase of 75 per cent. This development of the lighter traffic is, of course, prejudicial to the interests of small sailing ships; in fact the lighters are cutting out the sailers more and more every day, and this must have a great deal to do with the constant diminution in sailing tonnage which has now been going on for some years. A few figures will prove this. In 1899 the capacity in net registered tons of the lighters of all dimensions which passed through the North sea and Baltic canal, was 188,331 tons, and, in 1900, 209,539 tons. The capacity of the sailing ships, on the other hand, fell from 352,375 tons in 1899 to 338,198 tons in 1900. And if the increase on the one hand and the decrease on the other go on at the same rate the lighter traffic will be equal to that of the sailing ship in a few years. The conclusion arrived at by the writer of the article in the Annales is that the sea-going lighter offers very great advantages and a vast economy in working compared with both sailers and steamers. Its field of action is more extended, seeing that its smaller draught of water enables it to penetrate farther into the interior of a country, and to reach ports formerly inaccessible to sea-going vessels, and this is an advantage of the first importance. One tug, in the good season of the year, will take two or even three of these large lighters in tow, each of which can be utilized to the fullest extent of her carrying capacity, and can, besides, be placed at the respective quays or entrepots of different receivers of the cargo. And when the tug has placed the lighters at the quay it is at liberty to seek other employment, whereas the propelling apparatus of the steamship is idle as long as the vessel remains stationary. Pilotage fees are also much lower for a given quantity of cargo in the case of lighters, owing to their shallower draught. For instance, a steamer of 4,500 tons, with a draught of 24 ft., arriving at Antwerp, has to pay 2,000 francs (in round figures) for pilotage money, in the winter time, while the pilotage fees for three lighters of 1,000 tons each and a draught of 13 ft., would only amount to 1,050 francs. That is a saving worth consideration. In fact, M. Dufourny is of opinion that when short sea voyages are in question, lighters can thrive on lower rates of freight than either sailers or coasting steamers.

ECONOMY OF LARGE SHIPS.*

(By A. W. Robinson, M. Can. Soc. C. E.)

There is at the present time a marked tendency to increase the size and carrying capacity of ships, and it is a recognized fact that great economy results from such increase. It will be of interest at the present time to consider the limitations which govern this increase, and endeavor to obtain a clearer idea of the present stage in the development, and what may be expected in the near future. Especially will this be of interest in view of the general desire to obtain a faster Canadian line, and also to improve the freight service. A wide difference of opinion exists as to the most desirable speed and type of vessel, and a more definite knowledge and full discussion would do much to clear up the subject. Although the question is one which is really in the hands of the steamship owners and builders, an intelligent public opinion can do much to formulate the demands which the steamship builder has to meet. From the point of view of the vessel owners, steamships are designed, built and run solely for their dividend earning powers, and whatever economy conduces to this end contributes also to the advantage of the community at large, and is of interest from an engineering point of view.

The fact that increased economy is obtained by increased size and capacity has caused a wonderful advance, not only in steamships, but in the rolling stock of railways and, in fact, in almost all lines of mechanical industry. During the last ten years the paying load hauled by a locomotive has about doubled, and this is due to the increase of carrying capacity of the cars and the hauling capacity of the locomotives, and it is also due to the improvement of the road by reduction of grades and curves, the great value of which as a factor in economical railway transportation is now fully recognized and understood.

In ocean steamships a different state of conditions is found, and as no improvement can be effected in the natural highway of the sea, we must depend entirely upon the development of marine engineering in obtaining higher efficiency in engines and boilers, and in larger carrying capacity of the vessels themselves. It has been found that the propelling power required for a vessel for a given speed increases in a slower ratio than the increase of its displacement, and in this fact is found the main secret of the superior economy of large vessels. A good deal has been done during the past ten years in the improvement of engines and boilers of ships, and in the reduction of weight and space occupied by them, but this improvement is small compared with the increased economy produced by increasing the size alone. During the past ten years the paying load carried by a representative ocean cargo steamer has about doubled, while the average increase in fuel economy has been reduced from 1.52 lbs. coal per horse-power per hour to 1.48 lbs.—a comparatively small saving.

In this connection I may quote from a paper by Mr. James McKechnie, recently read before the Institution of Mechanical Engineers, on "Marine Engineering During the Last Ten Years." Mr. McKechnie states: "A ship to carry 5,000 tons requires machinery of 3,475 I. H. P. to propel her at 13 knots, while in the case of a ship of treble the capacity the power is scarcely double. In other words, the consumption of coal per 100 ton-miles in a now relatively small ship, taking 5,000 tons of cargo, is 8 lbs., while the vessel taking 16,000 tons uses only 4.4 lbs. per 100 ton-miles, the rate of consumption per unit of power per hour being assumed in all cases at 1.5 lbs. Not only is the fuel consumption per ton carried less, but the first cost per ton carried need not be greater, and the working expenses per ton generally are lower, because mechanical means are introduced more freely for many purposes, while the personnel does not increase pro rata with size."

It seems to be generally recognized that an ordinary sea speed of 13 knots is favorable for cargo-carrying economy, and the horse power and coal consumption per 100 ton-miles for different sized ships of from 5,000 to 14,000 tons deadweight carrying capacity at this speed is indicated in the following table by Mr. McKechnie:

TABLE TO ILLUSTRATE FUEL ECONOMY OF LARGE CARGO STEAMERS FOR NORTH ATLANTIC TRADE.

Dead-weight. Tons.	Displace-ment. Tons.	Dimensions, feet.	Draught, feet.	Speed at sea, knots.	Coal per 100 ton-mls., based n 1.5 lbs.
5,000	8 640	390 x 45.7 x 29.5	24.5	13	8.0
6,000	10.240	415 x 48.7 x 31.0	25.5	13	7.1
8,000	13,500	458 x 53.7 x 34.0	27.0	13	6.05
10,000	16,750	493 x 58.0 x 36.6	28.5	13	5.42
12,000	19,850	521 x 61.2 x 38.7	30.0	13	4.97
14,000	23,070	548 x 64.1 x 40.7	31.2	13	4.66
16,000	26,150	570 x 66.7 x 42.3	32.4	13	4.4

The above table is instructive as illustrating the comparative economy in coal consumption of different sized ships, and it will be seen that the dimensions stated also take into account the efficiency of the vessel for cargo-carrying purposes, because the deadweight carrying capacity or paying cargo tonnage is the space available in the hull of the ship after providing for machinery, coal bunkers, etc.

These figures show that, with the present contemplated depth of the St. Lawrence ship-canal, we can employ vessels 520-ft. long, 61-ft. beam, and 30-ft. draught, which can carry 12,000 tons deadweight, at 13 knots sea speed on 5 lbs. of coal per 100 ton-miles. It need hardly be said that this represents a vessel of considerably larger size than the average now frequenting Montreal, and it clearly indicates that the day of the small ship has passed, except for conditions under which large ships are inadmissible.

We will now consider what restrictions there are in the way of large ships in general, and especially as to bringing large ships up to Quebec and Montreal. The first limitation is that of depth of water in the channel, and the second is that of harbor capacity. As to depth of water, the work now in progress, and nearly completed, in deepening the St. Lawrence channel will give us a depth of 30 ft. at extreme low water. There will be more than this depth during the greater part of the season, as extreme low water is only reached for a short time in the fall of the year. As to harbor capacity, improvements of harbors all over the world are being carried out, both for depth of water and accommodation for rapid handling of cargo. This must keep pace with the vessel improvements if best results are to be attained, but at present it must be said that the vessels lead in the race, and it is "up to" the harbors everywhere to provide accommodation for them. It has been said by those competent to judge that vessels 1,000-ft. long and 40-ft. draught would be afloat today if harbor capacity and cargo facilities existed for them.

It will be seen, by referring to the table, that on 30 ft. draught of water a well-proportioned ship can carry 12,000 tons of cargo, the displacement being 19,800, and the ship itself being 521 ft. long and 61-ft. beam. The coal consumption of such a ship will be, say, 5 lbs. of coal per 100 ton-miles of paying cargo. This, it is safe to say, is very much less than the average cargo ship of today coming to Montreal, and the superior economy of such a vessel needs no further argument. It is evident from the table, and from the requirements of ships now building, that we have not reached finality in 30-ft. depth of channels. Vessels now building for New York will draw 36½ ft., and will not be able to load to full capacity until the new 40-ft. channels now being dredged for New York are completed.

It may be objected on the part of some that it would be dangerous to bring a vessel of such size up the river St. Lawrence owing to the narrowness and crookedness of the channel. This is largely a matter of experience, and, while there is room for difference of opinion on the subject, the writer's opinion is that it is not nearly so dangerous as it seems, and that on the whole a greater degree of safety and immunity from accident would be obtained by a large vessel than by several small ones of equal capacity. Experience shows that large vessels are not more difficult to handle with modern equipment than small ones. Steam steering gears are universal, and twin screws give great maneuvering power. The writer recently made a voyage in the Celtic, of the White Star Line, which is the largest vessel afloat, and observed the ease with which she was handled both in leaving her slip at New York and in entering the Mersey at Liverpool. On entering the Mersey the tide was running up, and the vessel had to turn a semi-circle opposite the landing stage and come alongside in what is probably one of the most crowded rivers in the world, and in which a number of ships were at anchor at the time, around which we had to pass. This was accomplished in as short a space of time, and with as much apparent ease, as if the vessel had been one-third the size.

As to the width and crookedness of the channel in the river St. Lawrence, the conditions are no worse than any other places where large vessels are used. The radius of the curves is much larger than the vessels are capable of turning. As to the width of the channel, the minimum width is now 300 ft. above Quebec, and it is proposed to widen it. Taking the width, however, at 300 ft., it does not seem to make much difference whether the vessel in the channel is 45-ft. beam or 60-ft. beam. In one case the beam of the vessel is 15 per cent. of the width of the channel, and in the other case it is 20 per cent., so that, while the capacity of the ship is vastly increased, the space it occupies in the channel is but very slightly increased. As a matter of fact but few accidents occur in the dredged ship-channel, as has been frequently pointed out, and it is well known that in the dredged channel in Lake St. Peter it is practically impossible for a deep-draught vessel to leave the channel or to get aground.

There are also other commercial considerations in favor of the large vessel for the St. Lawrence route. The first of these is that a large vessel such as we have under consideration will usually be commanded by higher-salaried and more competent officers than a smaller ship or tramp vessel. This means that the accidents, due to ignorance or negligence, and which may be classed as avoidable, will be reduced. There are also risks of the sea which may be classed as unavoidable. These will also be less with a large ship than with a small one, for the reason that a large ship does the work of, say, three small ones, or, in other words, carries as much cargo in one voyage as the smaller vessel will do in three. Consequently the risk from unavoidable disasters is one-third in point of time of exposure to such disasters for a given amount of commerce, and furthermore the large ship is more staunch and seaworthy, and thus better able to withstand the stress of the sea. The assertion that better-paid and more-skillful officers and crew of a vessel carries with it greater immunity from accident is borne out by the history of the lines coming to Montreal, as comparatively few accidents happen to the large and well-appointed regular liners whose officers and crew are experienced in the service. The majority of the ac-

*Paper read Nov. 6 before the Canadian Society of Civil Engineers.

cidents are those which have happened to the smaller class of vessels, and are due either to inexperience or negligence.

It may be of interest to refer to the dimensions and performance of the Celtic already referred to. Leading particulars of this vessel are as follows: Length, over all, 697 ft. 5 in.; beam, 75 ft. 4 in.; depth, 48 ft. 4 in.; gross tonnage, 20,800 tons; draught, 33 ft.; displacement, 33,550 tons; indicated horse power, 13,000; mean speed on passage, 16 knots. The coal consumption of the Celtic is equal to about 4 lbs. per 100 ton-miles, and is a most remarkable result, considering her very fair speed. A very similar vessel has recently been launched for the same line called the Cedric. This type of ship combines immense carrying capacity and great economy with moderate speed, and, owing to her great size, can carry a large amount of passenger accommodation on the upper deck without interfering with cargo space. This type of ship is coming into great favor with passengers, owing to the greater roominess and steadiness as compared with small ships. With a light wind abeam, the writer observed that the rate of lateral oscillation of the Celtic was only about 2½ times per minute. This is so slow as to cause practically no inconvenience to the most susceptible, and the angle was also very small.

Another very successful and economical ship of this type is the Saxonia of the Cunard Line. This vessel is of 19,808 tons measurement, and has a carrying capacity of 10,400 tons deadweight. The mean result of the engineer's log for a number of trips during the year 1900 showed the following: Average speed, 14.5 knots; indicated horse power, 10,078; coal per day, 138 tons; coal per horse power per hour, 1.28 lbs.

It is an unnecessary truism to say that large ships will not be economical unless they can be filled, but this aspect of the question merits more than passing notice. The difficulty of providing cargo for these large vessels is very great, and their advantage will not be realized unless there is a corresponding growth all along the line in facilities for receiving, warehousing and rapid handling of the different kinds of freight in large quantities. We have now considered the question of comparatively slow speed vessels for the economical carrying of cargo.

In the keenness of competition of the present day it is the large economic cargo carrier which will aid the most in the development of our ocean trade, and ships of very great speed are only required for the purpose of carrying mails, and for carrying the comparatively small number of passengers who are willing to pay the extra price for the saving of time. The subject of fast ships is always an interesting one to engineers, as it calls for the highest skill in design and construction, and the problem is no easy one. It is a great testimony to British ship builders that they have been and are still able to produce ships as fast as any in the world, although the Germans have the honors at present with the Kronprinz Wilhelm at 23.08 knots, and propose to beat it with the Kaiser William II., now building. It is satisfactory to see that the Cunard company now propose to build two boats of about 25 knots under a subsidy arrangement with the British government, and so the race for supremacy in speed goes on. This is a testimony that British builders stand ready to produce any vessel that the companies are ready to pay for, and that great speed is as much a commercial question as an engineering one.

The price of speed is so great that it precludes carrying freight economically or carrying freight at all, and the present tendency of British practice for general freight and passenger service is towards a type of vessel which combines moderate speed with large carrying capacity. It will be interesting to compare the speed and carrying capacity of two of the largest ships in the world now building, the Cedric and the Kaiser William II.—the Cedric, representing a type of vessel having large capacity combined with moderate speed, and the Kaiser William II representing a type in which everything is sacrificed to speed.

	Displacement.	I. H. P.	Speed.	Dead-weight.	Pass. accomo.	Tons coal per day.
Cedric	37,800	14,000	17	18,000	3,000	260
Kaiser Wm. II.	26,000	40,000	24	none.	1,800	750

It is apparent from the foregoing figures that the extra 5 knots speed is obtained at the cost of an additional coal consumption of nearly 500 tons per day, and that the passenger accommodation is much less and the cargo capacity entirely lost. This will give some idea of the enormous cost of high speed. The question as to how fast the proposed Canadian fast line should be is purely a commercial one, and depends entirely upon what we are willing to pay for it, and is outside the scope of this paper. In the following table is given the leading dimensions of some of the larger vessels now coming into Montreal.

	Length feet.	Beam. feet.	Depth. feet.	Load dra'ght feet.	Gross ton'age	Dead-weight tons.
Sicilian	430	54	28	25½	6,126	8,200
Pretorian	437	53	29½	26¾	6,203	8,379
Tunisian	500	59	35½	....	10,576	.....
Milwaukee	469	56	34¾	27¼	7,323	11,700
Montfort	444	53	31¾	25	7,101	7,910
Lake Manitoba	469	56	31¾	25¾	8,852	10,000
Lake Champlain	446	52	27¾	27	7,392	8,877
Montezuma	485	59	30½	....	7,345	.....
Montreal	469	56	34¾	27½	6,780	10,622

WORLD'S COAL SUPPLY AND TRADE.

"The World's Coal Supply and Trade," is the title of a monagraph just issued by the treasury bureau of statistics. It shows that the United States not only leads the world in coal production but has advanced from third place to the head of the list since 1880. In that year the United States produced one-fifth of the coal of the world; last year its production was one-third of the total of the world. The coal production of the United States has quadrupled since 1880, while that of the remainder of the world has not quite doubled. The three great coal-producing countries of the world are the United States, United Kingdom and Germany. These three countries produce practically 80 per cent. of the world's coal. Since 1880 the United States has increased her output by 221,000,000 short tons, Germany by 103,000,000 tons, and the United Kingdom by 80,000,000. The relation of these three great coal-producing countries to the world's coal supply, and the growing importance of the United States in that relationship are indicated by the following table which shows the production in each of the three, and in all other countries, in 1880 and 1901, and the actual increase and per cent. of increase in each case:

Countries.	Production in 1880. Short tons.	Production in 1901. Short tons.	Increase from 1880 to 1901. Short tons.	Per cent. of increase.
United States	71,481,569	293,298,516	221,816,947	310.6
United Kingdom.	164,605,738	245,332,578	80,726,840	49.2
Germany	65,177,634	168,217,082	103,039,448	158.4
All other	63,472,464	155,317,364	91,844,900	144.8

It will be seen from the above figures that the United States not only advanced from third place to first in the period from 1880 to 1901 but that her actual increase in production was nearly as much as that of all the rest of the world combined, the actual increase from 1880 to 1901 being: United States, 221,816,947 short tons; all other countries, 275,611,188 tons.

The following table shows the coal production of the world in the latest available year, the figures for the United States, United Kingdom, Germany and France being for 1901, the others for 1900:

Countries.	Short tons.	Per cent of total.
United States	293,298,516	33.86
United Kingdom	245,332,578	28.32
Germany	168,217,082	19.42
Austria-Hungary	43,010,761	4.96
France	35,596,536	4.11
Belgium	25,856,024	3.00
Russia	17,799,016	2.00
Japan	8,187,262	1.00
Other countries	28,867,765	3.33
Total	866,165,540	100.00

While the United States is the world's largest producer it has as yet accomplished little as an exporter. The following table shows the exportation of coal in excess of imports, of all countries whose exports exceed the imports. The figures are in metric tons of 2,204 lbs. and are for the latest available year, in most cases for 1901:

Countries.	Exports in excess of Imports. Metric tons.	Countries.	Exports in excess of imports. Metric tons.
United Kingdom	57,775,000	Belgium	3,264,000
Germany	11,103,000	Japan	2,809,000
United States	5,463,000	Natal	302,000
New South Wales	3,362,000	India	239,000

The following table shows the total importation of coal in the principal countries of the world at the latest available year, in metric tons, and thus indicates the principal markets of the world:

Countries.	Imports of coal. Metric tons.	Countries.	Imports of coal Metric tons.
France	13,929,000	Belgium	3,102,000
Germany	6,790,000	Spain	2,153,000
Austria-Hungary	6,440,000	Australasia	1,285,000
Italy	4,839,000	Argentina	929,000
Canada	4,343,000	Brazil	790,000
Russia	3,631,000	Mexico	760,000
Sweden	3,130,000	Cuba	372,000

Reid & Sons, Sarnia, Ont., have taken wrecking apparatus to the Straits of Mackinaw for the purpose of removing a sunken vessel, the Winslow, which lies to the northwest of White shoal and is a menace to navigation.

A large cargo of grain, 201,652 bu. of barley and 55,000 bu. of wheat, or 256,652 bushels in all, was unloaded at Buffalo a few days ago by the steamer L. C. Smith, of which Capt. W. W. Brown of Cleveland is manager.

Maj. W. H. Bixbv, United States engineer with headquarters at Detroit, says he will ask the war department for an allowance to build a steamer for his use. He wants a steamer about 125-ft. long, 30-ft. beam and 8-ft. deep.

Three lumber vessels, formerly managed by S. R. Chamberlain of Chicago, were sold at marshal sale in that city Monday. The steamer H. Luella Worthington sold for $9,700 to J. O. Nessen & Co., the schooner A. T. Bliss to Clinton Woolfolk for $2,025, and the John B. Wilber to Thomas Bradwell for $800.

NAVY BACK OF A NEW BOILER.

Co-operation with the Oil City Boiler Works in Development of a Water-Tube Generator for Ships—Bureau of Steam Engineering Describes the Boiler and Publishes Reports of Tests.

It has been generally known in vessel circles for some time past that the Oil City Boiler Works of Oil City, Pa., a very large boiler-making concern, has been experimenting with a water-tube boiler for ships—merchant as well as naval; that they approached the navy department with a proposition to spend $50,000 to $100,000 in experiments, and that the navy has been co-operating with them. The boiler is known as the Hohenstein. Admiral Melville, chief of engineers, tells all about the boiler and the experiments in his annual report, just from the press. He endorses it as the equal in efficiency and endurance of any used in a foreign battleship. Following is Admiral Melville's report regarding this boiler:

The present problem of the modern battleship is not that of the gun and its mount, but the boiler and its installation. The gun is mounted in the most favorable position for care, operation, and inspection, and practically everything on board ship is subordinated to its efficient working. Since a large factor of safety is given to every part of the weapon that is subjected to shock, the gun can only be impaired by incompetence, neglect, or by chemical action of the explosive. Before it is placed in a turret or redoubt it is fully tested, but it is never put on board ship if there is a suspicion that it has been subject to undue strain. The boiler, on the other hand, is placed beneath the protective deck just above the bilges and near the bunkers. It is installed in compartments that are avoided rather than sought by other than engineer officers. While a careful test is made of the structure before being placed in the vessel, it must necessarily be subjected, even before installation, to conditions that often impair its strength. In its construction many of the plates are subjected to the severest kind of flanging, and its efficient inspection is much more difficult than that of the gun. As there has been a progressive demand for increased steam pressures, the factors of safety used in designing a marine boiler are progressively becoming smaller. The conditions under which the boiler is operated necessarily cause some of the parts to be subjected to rapid corrosion, and only incessant care and attention can prevent the disablement or rupture of the structure.

The experience of the United States navy with the boilers of the torpedo boats and torpedo boat destroyers ought to afford some startling evidence as to the manner in which incompetent or untrained men can impair or destroy the efficiency of these steam generators. The agitation in Great Britain over the navy boiler question ought also to convince naval administrators that the boiler problem is the naval problem of the hour. In view of the British experience with the Belleville boiler, it is not surprising that the general public of that empire regard the boiler commission, now in session, as the most important board appointed by the admiralty during the past ten years. The membership of this board comprises distinguished experts within and without the naval service. This board has been in session nearly two years investigating the question as to which type of marine boiler is most suitable for use in the navy as the one of approved design. The admiralty regard the solution of this problem as of vital importance to the efficiency of the British fleet, for it has been discovered, after installing over 1,250,000 H. P. of boilers of particular design, that a doubt has arisen as to whether or not this particular form of boiler should have been settled upon as the approved type for the naval service. A series of evaporative and endurance tests have been made, and the more carefully the question is investigated the more important does it appear in relation to the operation of a modern navy. The work of the British boiler commission will have a very important influence upon naval construction, since it will cause thoughtful experts to give more attention to the design, construction, installation and operation of the boiler. One must have experience in the operation of a modern marine boiler to appreciate the intelligence, skill and care that must be devoted in keeping it in a state of efficiency. The boilers are the lungs of a vessel, although this fact is not generally understood. It was not many years ago when a naval officer of high rank spoke of the boilers as "the steam tanks in the bottom of the ship," it being probably his impression that these tanks could be tapped like a gasometer, and it was the fault of the fireman if the boiler output was not sufficient at all times.

While the war ship may be nothing more than a gun platform, it requires considerable power to move a platform of 14,500 tons at a high speed in a heavy sea. This platform is not only expected to be maneuvered rapidly, but to steam uninterruptedly for a distance of one-fourth the way around the world. The battleship that can not make the enemy's coast the first line of defense is limited in the field of its usefulness, and when operating at such distance the value of the boiler factor comes only second to the value of the factor of the gun. The efficiency of the war ship of the several naval powers is simply proportionate to the efficiency of their boilers and the character of their personnel. Neither in armor, armament or machinery is there any vital difference between the battleship of the several nations. In these respects, the last ship, wherever designed, is the best, for as regards draught, tonnage, thickness and extent of armor, character and distribution of guns, and design of machinery, ever nation has settled upon a type of vessel that meets its particular requirements, and each navy has therefore secured the best for its particular purpose.

BOILER PROBLEM NOT YET SOLVED.

The boiler problem, however, has been unsolved. Without taking into consideration the question of personnel, the value of the war ships of the different naval powers can be measured by the efficiency and endurance of the steam generator installed in the vessel. This fact may not be appreciated in its fullness at the present time, but the experience of the coming five years with the ships nearing completion will conclusively show that in coming naval conflicts the question of victory may be quite as much dependent upon the battle of the boilers as the contest between the guns. With the deep appreciation of the necessity of soon settling upon an approved type of marine boiler for the battleships and armored cruisers of the United States navy, the bureau has invited competition among designers. It believes, however, that, if possible, a boiler of American design should be adopted, and that this marine boiler should be a development of one in general use on shore. By seeking a design that is familiar to thousands of firemen on shore, an important military advantage would be secured since in time of emergency there could thus be recruited for the naval service water tenders and firemen who had operated almost similar steam generators, and who would therefore require but little training to familiarize themselves with the duty on board ship. While the navy can and ought to do some efficient work in training firemen, it would be very advantageous to the service if the enlisted force in the stokeholes could have considerable preliminary training with boilers of nearly like design to the one in most extensive use as the approved type of the navy. There is now being built for the battleships in course of construction, water-tube boilers of three distinct types. Practically four-sevenths of this boiler power will be of the Babcock & Wilcox design, two-sevenths of the Niclausse, and one-seventh of the Thornycroft. These types include the best of representative groups of water-tube boilers, and a sufficient installation of each kind will be secured to test the efficiency and endurance of the several designs.

About two years ago the bureau was informed that another American boiler firm, with considerable financial backing, desired to enter the field of marine boiler construction. In keeping with the bureau's policy of inviting competition, encouragement was therefore given the Oil City Boiler Works to design and build a marine boiler and turn it over to the bureau for test as to its evaporative efficiency and endurance. The question of entering upon the field of marine boiler construction had been carefully considered by the Oil City Boiler Works. As the officials of that establishment believed that the time was not far distant when there would be a large demand for marine water-tube boilers, they volunteered to equip an experimental plant at the company's expense. The boiler was of sufficient size to thoroughly test its adaptability for naval purposes. There was therefore constructed a steam generator whose limitations as to weight, height and floor space were similar to the conditions prescribed for the cruiser Denver, and these conditions are in many respects the most severe that have been exacted by the department. Eighteen months ago the experimental plant was completed, and there was placed at the disposal of the bureau a boiler of the Hohenstein design. The boiler was installed in an air-tight steel house, this structure likewise approximating to one of the fire rooms of the cruiser Denver. All the limitations and difficulties that were met with in the installation of the boilers of the cruiser Denver were therefore designedly encountered in the installation of the experimental plant.

BIG SUM OF MONEY SPENT ON EXPERIMENTS.

It was well understood before the bureau undertook the experiment with this boiler that the character and extent of the data to be collected were to be entirely determined by officials of the government. In justice to the Oil City Boiler Works it should be stated that every suggestion of the department was carried out, and that it was the evident purpose of the company to accurately ascertain the requirements of the Bureau, and to discover the greatest difficulties that were likely to be experienced in meeting naval demads. Stated in a business way, the company was willing to expend from $50,000 to $100,000 to ascertain whether or not it would be advisable to extend their plant to enter the field of marine boiler construction. In many respects the experimental plant was one of the most complete that have ever been established. The series of tests conducted will command attention in the engineering world, for absolute information has been obtained as to the evaporative efficiency and endurance of the boiler. Information has also been secured in regard to the best means of baffling the gases, thus increasing the evaporative efficiency as well as permitting the boiler to be forced for emergency purposes. Particular care has also been given by the board to the investigation of the circulation of the water, for probably the key to the boiler problem is the question of circulation.

While only seventeen official tests were made with coal as fuel, there were a great many unofficial experiments. Between the several official tests the experts of the Oil City Boiler Works conferred with the bureau, and therefore each test represents the result of study and experiment. An examination of the data will conclusively show that in many respects the completeness and

character of the tests have never been surpassed. The first six tests were run by a picked crew of firemen who had experience in torpedo boat work. It was believed that these men by training and experience were particularly well fitted to operate the boiler when under severe forced draft conditions. An experience of a few weeks with this force showed that new methods in firing had to be employed in efficiently operating water-tube boilers, and that the best means of securing efficient work was to have skill and intelligence from those in charge of the fire room and implicit obedience upon the part of the subordinates. The remaining eleven tests were thus made by firemen living in the city, not one of whom had ever before worked a boiler under forced draft conditions. The second set of firemen implicitly obeyed orders, and it was therefore possible for the board to have its instructions carried out. A uniform pressure of steam was maintained, as well as a regularity in firing that was productive of good results.

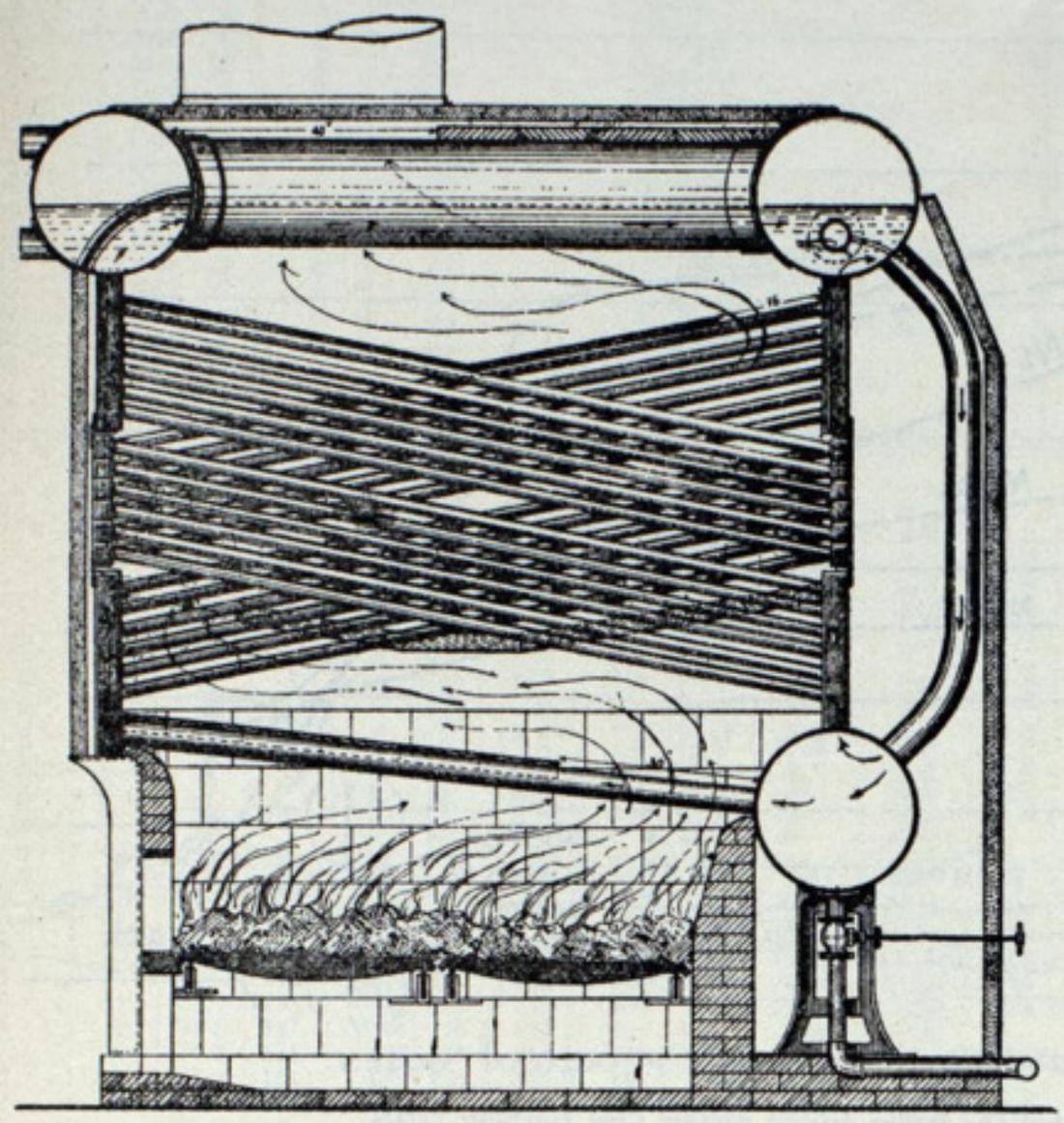

Fig. 1. Longitudinal Section Hohenstein Water-Tube Boiler.

The data secured can be regarded as reliable, for checks and counter checks were used so that the bureau could be placed in possession of information that could be relied upon as to completeness and accuracy. As this same boiler is being used to carry on the extended series of tests to determine the value of liquid fuel for naval purposes, it is proposed to duplicate every one of the coal tests with oil as a combustible. The comparative information thus obtained ought to afford valuable data as to the relative value of the two combustibles. In view of the present condition of this experimental boiler after eighteen months of use with both coal and oil as a combustible, considering the results secured, and by reason of the following report submitted by the board which conducted the series of tests, the bureau has no hesitation in regarding the boiler as the equal in efficiency and endurance of any used in a foreign battleship.

REPORT OF BOARD ON HOHENSTEIN BOILER TRIALS.

BUREAU OF STEAM ENGINEERING, Navy Department, July 1, 1902.

Sir:—The board appointed to conduct an extended series of tests to determine the efficiency and adaptability of the Hohenstein marine boiler for naval purposes submits the following report:

The boiler was built by the Oil City Boiler Works of Oil City, Pa., in conformity with the bureau specifications for the cruiser Denver and class. The limitations as to weight, height and floor space in regard to the Denver's steam generators were therefore taken into account in the construction of this boiler. The installation was affected in an air-tight steel house, the dimensions of this house approximating to one of the fire rooms of the Denver. It may be incidentally stated that the specifications for the boilers of the Denver are probably as severe as those for any American war ship. The headers of the boiler are made of wrought steel, a special requirement of the bureau. While only seventeen official tests were made with coal as fuel, there was considerable experimentation between these tests, so that the series of tests represent much more observation and experimentation than is apparent. A most noteworthy feature of the boiler is the arrangement of the tubes in pairs in such a way that each tube is free to expand independently of other tubes, thus effectually preventing longitudinal stresses in them. Figure 1 shows a longitudinal section of the boiler. Attention is called to the fact that the entire down flow takes place within tubes which are located in a comparatively cool place, while, on the other hand, there is invariably an upward trend to the current in all tubes and headers exposed to the hot gases. It is therefore highly probable that there are no reverse currents at any part of the water circuit, and the cross-section areas of tubes and headers are equitably apportioned with a corresponding degree of certainty. The feed water is introduced at the top of the down-take tubes, which is obviously the best possible place as regards influence on the circulation; at the same time the head due the velocity of the feed water is conserved by means of injector nozzles pointing in the direction of the flow. The following are the more important dimensions:

Drums at water-surface level:—One front drum, 24 in. diameter (inside); one rear drum, 24 in. diameter; four connecting drums, 16 in. diameter.

One lower rear mud drum, 24 in. diameter.

Tube-heating surface:—Three hundred and eighty-four 2-in. tubes, 9 ft. long; sixteen 4-in. tubes, 7 ft. long.

Fifteen down-take tubes, 5 in. in diameter.

Floor space occupied, 9 ft. wide, 10 ft. 11¼ in. deep.

Height above floor line, 12 ft. ¾ in.

Height over all, 12 ft. 6¾ in.

Heating surface:—2,174 sq. ft. for tests No. 1 to No. 6, inclusive; 2,130 sq. ft. for tests No. 7 to No. 17, inclusive. Per cent. water-heating surface, 100.

Grate surface—50.14 sq. ft., 6 ft. 4 in. long, 7 ft. 11 in. wide.

Pressure of heating surface to grate surface—43.4 to 1 for tests No. 1 to No. 6, inclusive; 42.5 to 1 for tests No. 7 to No. 17, inclusive.

Volume of water at steaming level, 142 cu. ft.

Volume of steam space, 50 cu. ft.

Area of steam liberating surface, 75 sq. ft.

Weight of water at steaming level and 275 lbs. pressure, 7,559 lbs.

Weight of boiler and fittings, excluding up-take and smoke pipe—Without water, 46,568 lbs.; with water, 54,127 lbs. Without water per square foot of heating surface, 21.4 lbs. for tests No. 1 to No. 6, inclusive; 21.8 lbs. for tests No. 7 to No. 17, inclusive. With water per square foot of heating surface, 24.9 lbs. for tests No. 1 to No. 6, inclusive; 25.4 lbs. for tests No. 7 to No. 17, inclusive. With water per square foot of grate surface, 1,080 lbs.

Height of furnace, 2 ft. 5 ins.

Volume of furnace above bars, 121.14 cu. ft.

Width of air spaces between grate bars—Five-eighths inch for tests No. 1 to No. 11, inclusive; ¾ in. for tests No. 12 to No. 17, inclusive.

Ratio of grate area to area of air space—1⅛:⅝=1:0.555 for tests No. 1 to No. 11, inclusive; 1¼:¾=1:0.60 for tests No. 12 to No. 17, inclusive.

Height of smoke pipe above grate, 70 ft.

Area of smoke pipe, 8.73 sq. ft.

Ratio of smoke-pipe area to grate area, 1:5.75.

Number of fire doors, 3.

The boiler was erected in a steel structure built especially for these tests and having the following dimensions: Floor space, 16 ft. by 24 ft.; height, 14 ft. The structure was air tight, had

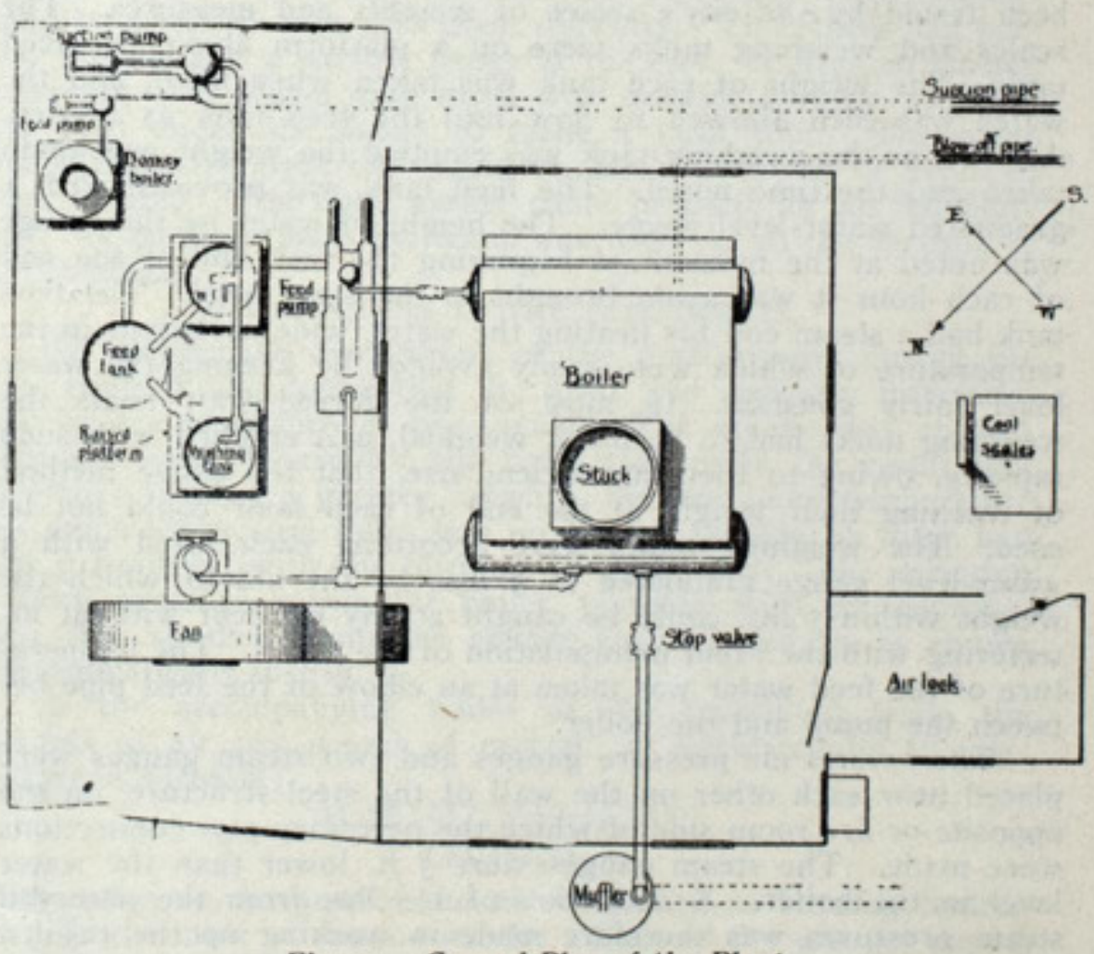

Fig. 2. Ground Plan of the Plant.

an air lock for entrance and exit during forced-draft trials, and seven windows that could be opened during natural-draft trials. Figure 2 shows the ground plan. The auxiliary machinery, together with facilities for making observations, were, so far as possible, placed in an adjoining lean-to wooden structure. The auxiliaries consisted of a Davidson suction pump, two weighing tanks, one feed tank, a Snow high-pressure feed pump, a small upright boiler with independent feed pump, and a direct-connected blowing engine and fan. The fan had an impeller 72 ins. in

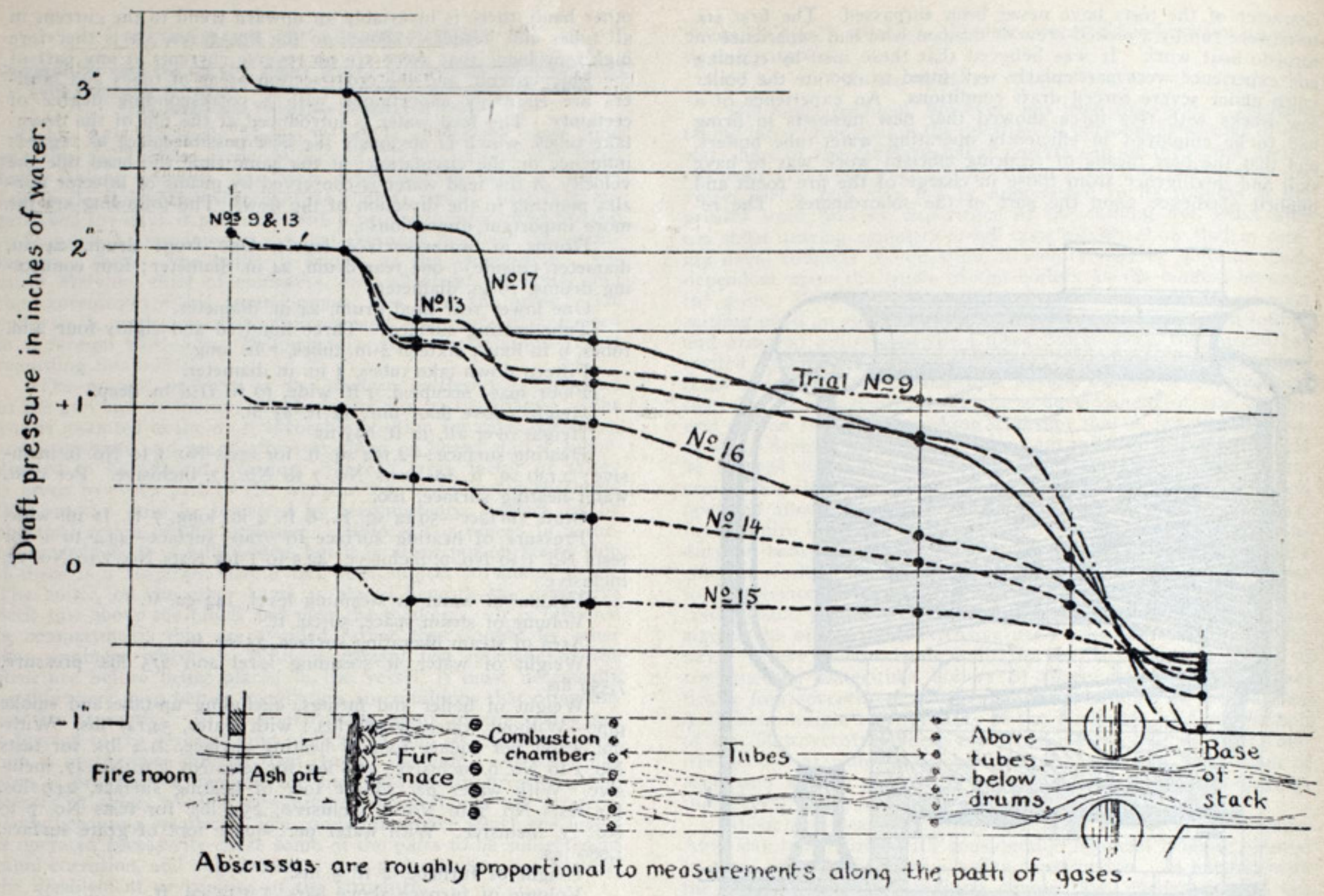

Fig. 3. Curves showing Variation of Air Pressure within the Boiler during certain Coal Burning Trials. Spots indicate points where measurements were made.

diameter and a discharge duct 20 ins. by 42 ins., which led to the fire room and terminated in a box placed so as to direct the air current toward the ceiling. The pipe connections were such that steam for the auxiliaries could be taken either from the small upright boiler or from the main boiler. The bottom blow valve was blanked, but in plain sight, so that leakage from that source would be particularly observed.

ARRANGEMENTS FOR THE EXPERIMENTS.

The feed water was weighed in two tanks, each of 1,000 lbs. capacity, and resting on 1,500-lb. Howe scales. These scales had been tested by the city's sealer of weights and measures. The scales and weighing tanks were on a platform above the feed tank. The weight of each tank was taken when filled, and the water was then allowed to flow into the feed tank as needed. As soon as the weighing tank was emptied the weight was again taken and the time noted. The feed tank was provided with a graduated water-level gauge. The height of water by this gauge was noted at the moment of beginning the test, and at the end of each hour it was again brought to the same level. The feed tank had a steam coil for heating the water, wide variations in the temperature of which were easily avoided by keeping the water level fairly constant. In most of the forced-draft trials the weighing tanks had to be filled, weighed, and emptied with such rapidity, owing to their insufficient size, that the above method of catching their weight at the end of each hour could not be used. The weighing tanks were according each fitted with a water-level gauge graduated to 5 lbs., by the aid of which the weight within 5 lbs. could be caught at any moment without interfering with the rapid manipulation of the tanks. The temperature of the feed water was taken at an elbow of the feed pipe between the pump and the boiler.

The several air pressure gauges and two steam gauges were placed near each other on the wall of the steel structure, on the opposite or fire room side of which the necessary pipe connections were made. The steam gauges were 3 ft. lower than the water level in the boiler. A deduction of 1½ lbs, from the observed steam pressures was therefore made in working up the results. The steam was blown off into the atmosphere, the pressure being controlled by a hand-operated stop valve.

The coal was weighed in sheet-metal cans or bags, the method being to adjust each can or bag to a uniform weight of 220 lbs., or 130 lbs. while on the scales, and then keep tally of the number passed into the fire room. Beginning with the seventh test, the coal account was balanced at the end of each hour by estimating and deducting the weight of coal lying at the moment on the fire room floor. The ashes and refuse were weighed in sheet-metal cans as they accumulated, and the weight of sweepings from tubes and baffles was ascertained for each test on the day following the test. A sample of coal for analysis and for the determination of moisture by weighing and drying was taken from a box which had been gradually filled during the test by specimens taken from each can or bag as weighed. The following table gives the results of analysis of samples of each lot of coal. The analyses were made by the chemist at the New York navy yard.

Analyses of Fuel.

	Pocahontas coal, run of mine.		New River coal, run of mine.	Pocahontas coal, hand picked and screened.
	Fuel burned in boiler test No.—			
	1, 2. 3.	4, 5, 6.	7, 8, 9.	10 to 17
Proximate Analysis.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent*
Fixed Carbon	73.30	75.78	72.99	76.81
Volatile Matter	17.61	19.53	21.79	19.62
Moisture	.49	.79	.49	.73
Ash	8.60	3.90	4.73	2.84
	100	100	100	100
Sulphur, separately determined	.48	.71	.46	.82
Ultimate Analysis.				
Carbon	82.26	84.96	83.60	85.94
Hydrogen	3.89	4.07	4.85	4.45
Oxygen	4.12	5.46	4.87	4.50
Nitrogen	.64	.90	1.41	1.14
Sulphur	.49	.71	.46	.82
Ash	8.60	3.90	4.81	3.15
	100	100	100	100
Calorific value (B. T. U.'s per lb).				
Coal	14,067	14,534	14,841	14,992
Combustible	15,391	15,124	15,684	15,475

The quality of the steam was determined by means of a Barrus throttling calorimeter, which drew steam from the main steam pipe at a point 8 ins. from the boiler. The sampling nozzle consisted of a ½-in. pipe reaching nearly across the steam pipe on a horizontal diameter and having four rows of perforations (top, bottom and sides) extending the length of the diameter of the inside of the steam pipe, save for one-half inch at each end An extra calorimeter was fitted and readings were taken from both calorimeters throughout the series of trials, except when, as once occurred, the extra calorimeter got out of order by the lodgment of black scale in its throttle orifice. The temperatures at the base of the stack and the samples of flue gas were taken above the roof at a point about 5 ft. from the nearest heating surface of the boiler, measured along the path of flow of the gases. In the natural draft trials the temperatures were taken with a mercury-nitrogen pyrometer, and attempts were made to do the same in the forced-draft trials. Momentary flaming in the stack, however, caused so many breakages of glass bulbs that reliance had finally to be placed on a Brown quick-reading pyrometer, the readings of

Summary of Seventeen Tests of Hohenstein Marine Boiler.

Number of trial.	Date of trial.	Duration of trial (hours)	Kind of fuel (P., Pocahontas coal; N. R., New River coal; r. m., run of mine; h. p. s., hand picked and screened).	State of weather.	Height of barometer at noon.	Average pressures. Steam pressure by gauge; corrected for water level, pounds per square inch.	Draft pressures, in inches of water. Fire room.	Ash pit.	Furnace.	Combustion chamber.	Tube chamber.	Above tubes and below drums.	Base of stack	Revolutions of blower per minute.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	1891.													
1	Apr. 23	8	P., r. m	Clear	30.02	263.9	0.0	—0.05					—0.52	0
2	Apr. 26	6	do	Dull and overcast	30.12	272.9	1.08	1.02					— .65	250
3	May 8	4	do	do	29.86	274.6	2.06	2					— .84	335
4	May 29	8	do	Squally	29.70	271.3	0.0	— .04	—0.18	—0.20	—0.21		— .24	0
5	June 5	6	do	Bright and sunshiny	30.08	272.5	1.06	1.02	.80	.62			— .41	243
6	June 8	3½	do	do	29.95	270.5	2.03	2	1.56	1.41			— .22	375
7	Oct. 21	8	N. R., r. m	Clear	30.34	273.5	0.0	— .05	— .16	— .12	— .22		— .50	0
8	Oct. 23	5	do	Cloudy	29.95	273.5	1.07	1	.81	.72	.52		— .46	243
9	Oct. 26	4	do	Smoky	30.25	273.5	2.10	2	1.43	1.25	1.08		— .98	375
10	Nov. 6	8	P. h. p. s	Clear and damp	30.20	273.5	0.0	— .05	— .15	— .14	— .19		— .55	0
11	Nov. 9	8	do	Cloudy, occasional sun	30.18	273.5	0.0	— .05	— .09	— .09	— .11		— .55	0
12	Nov. 18	6	do	Gray and overcast	30.09	273.5	.99	.97	.79	.69	.51		— .55	240
13	Nov. 27	4	do	Thin clouds	30.23	273.5	2.10	2.00	1.58	1.18	.86		— .77	375
14	Dec. 16	6	do	Smoky, with thin clouds	30.13	273.5		1.00	.57	.32	.06	—0.20	— .59	243
15	Dec. 18	8	do	do	30.01	273.5		0.	— .20	— .20	— .25	— .38	— .51	0
16	Dec. 21	4	do	Smoky, no clouds	30.28	273.5		2.00	1.41	.93	.24	— .07	— .64	332
	1892.													
17	Jan. 11	3	do	Dark, fog and smoke	29.58	273.5		3.00	2.16	1.44	.82	.10	— .55	423

Number of trial.	Approximate fire-room air pressure.	Average temperature. (External air (Deg. F).	Air in fire-room (Deg. F).	Chimney gases (Deg. F).	Feed water entering boiler (Deg. F).	Steam at gauge pressure (7) from steam tables (Deg. F).	Fuel. Weight of wood used in starting fires (pounds).	Weight of coal used in starting fires (pounds).	Weight of coal used during test (pounds).	Total weight of fuel used (pounds), (21)+(22)+(23).	Weight of ashes before beginning test (pounds).	Weight of ashes during test (pounds).	Weight of refuse from furnace, tubes, baffles, etc. (pounds).	Total weight of ashes and refuse (pounds), (25)+(26)+(27).	Percentage of ashes and refuse, (28)÷(24)×100.	Weight of ashes and refuse from coal used during test (pounds), (23)×(29)÷100.	Percentage of moisture in coal (*by weighing and drying sample; †by chemical analysis).	Weight of moisture in coal used during test (pounds) (23)×(31)÷100.	Weight of dry coal burned during test (pounds), (23)—(32).	Weight of combustible burned during test (pounds), (33)—(30).	Steam. Quality of steam.	Percentage of moisture in steam, 100—100×(35).
1	8	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	0	57.2	93.8	594	144	410.4	350	2,400	9,720	12,470	260	377	640	1,277	10.24	995	0.50	49	9,761	8,676	0.980	2
2	1	70.3	117.8	751	145.4	413.3	300	2.000	10,445	12,745	160	575	550	1,285	10.08	1,053	.50	52	10,393	9,340	.968	3.2
3	2	72.8	121.7	1,089	145.8	413.7	390	2,500	10,569	13,459	195	459	815	1,469	10.91	1,153	.50	53	10,516	9,363	.989	1.1
4	0	64.4	114	688	137	412.7	340	2,000	8,633	10,973	175	226	549	950	8.66	747	† .79	38	8,565	7,818	.990	1
5	1	84.1	139.5	712	129.3	413.1	360	2 200	10,695	13,255	200	1,038	539	1,777	13.40	1,432	† .79	85	10,610	9.178	.988	1.2
6	2	74.8	127.	1,105	116.5	412.5	(?)	(?)	8 461	8.461	(?)	591	626	1,217	14.37	1,216	† .79	67	8,394	7,178	.990	1
7	0	71.3	144	563	131.8	413.6	360	2,000	8,056	10,416	198	485	561	1,244	11.95	963	3.14	253	7,803	840	.986	1.4
8	1	74.3	124	654	126.1	413.6	250	1,910	9 698	11 858	161	365	528	1,054	8.89	862	3.14	304	9,394	8,532	.976	2.4
9	2	67	106.5	688	111.8	413.6	361	2.200	9,000	11,561	152	391	732	1,275	11.03	993	3.14	283	8,717	7,724	.980	2
10	0	62.7	125	548	125.9	413.6	350	2,792	8,299	11,441	225	214	526	965	8.44	700	2.04	169	8,130	7,430	.988	1.2
11	0	55.1	123.4	521	122.3	413 6	350	1,435	7,436	9,221	303	584	356	1,243	13.48	1,003	1.15	85	7,351	6,348	.987	1.3
12	1	52	105	580	119 7	413 6	350	2,762	8.388	11.500	526	837	562	1,925	16.75	1,405	1.59	134	8.254	6,849	.983	1.7
13	2	40.2	86	717	91 4	413.6	310	2,762	10,694	13,766	267	460	936	1,663	12 08	1,292	1	107	10,587	9,295	.979	2.1
14	1	32.3	77	765	104.6	413 6	350	3,256	14,029	17,635	271	714	923	1 908	10.82	1,518	† .73	102	13.927	12,409	.980	2
15	0	26	87	568	125	413.6	360	2,440	9,181	11.981	235	702	576	1,513	12.63	1,160	† .73	67	9,114	7,954	.985	1.5
16	2	22	64	800	98.4	413.6	450	3,130	12,612	16,192	105	646	895	1,646	10.18	1,285	† .73	92	12,520	11,235	.978	2.2
17	3	35.4	76.5	943	88	413.6	350	3,554	10,862	14.766	151	254	1,355	1.760	11.92	1,295	† .73	79	10,783	9,488	.974	2.6

which were, however, checked as well as could be by the melting points of zinc, aluminum and copper. The samples of flue gas were drawn by means of an aspirator improvised from two half-gallon bottles. The sampling tube was one-half inch in diameter and extended to the center of the stack, the inner end being nearly closed and the sides being perforated with one-eighth-inch holes spaced four inches apart. The aspirator, charged with gas, was carried to a neighboring building, where the samples were analyzed by the aid of an Orsat apparatus.

The following determination was made of the actual weight of water contained in the boiler at a temperature of 56° F. and at different gauge-glass readings, the correct steaming level being at 1 in.

Height of water in gauge.	Total weight of water.	Difference.	Area of water level.
	Pounds.	*Pounds.*	*Sq. ft.*
0	8,588	281	52.2
1 inch	8,869	366	70.5
2 inches	9,235	413	79.6
3 inches	9.648	385	74.2
4 inches	10,033	372	71.7
5 inches	10,405		

The feed water was always muddy and especially so for the fourteenth and subsequent tests. The water was drawn from the Potomac river through a suction pipe that ran out to the end of a dock. When about to start the fourteenth test a long reach of the suction pipe was found frozen solid. To avoid postponing the test the pipe was quickly rearranged so as to draw from a point farther in, where the water was only 3 or 4 ft. deep and very muddy. The last test was to have been of 3½ hours duration, but it was brought to a sudden close at 1.02 p. m. by the failure of the feed water. The outflowing tide had exposed the end of the suction pipe, but before this became known the furnace doors were thrown open and the fires hauled. It was several minutes before the blowing engine was stopped, so that, in the meantime, the tubes were exposed to the blast of cold air from the 4 in. of air pressure. There was no appearance of leakage at this or at any other time during the seventeen trials.

In this connection the construction of the plugs in the headers opposite the tube ends is worthy of special remark. These plugs are of composition. There are two sizes, 2⅜ ins. and 4½ ins. in diameter with, respectively, 11½ threads and 8 threads per inch. The material of the plugs, together with the use of a graphite lubricant on the threads, makes it possible to remove and replace them without difficulty after any length of service. Also, by virtue of the greater expansion coefficient of composition as compared with steel, the plugs are tighter at steaming pressure than at ordinary temperature (70° F.) by 0.0026 in. and 0.0049 in., respectively, for the 2⅜-in. and 4½-in. sizes. Part of these plugs were made with tapering threads such as are inserted in the ordinary screwed pipe joints and depend for tightness on the threads alone. The joints thus formed were tight, but the plugs could be removed only with great difficulty. The others had parallel threads and a narrow flange at the end. A McKim gasket, consisting of a copper ring fitted with suitable packing material, was used under the flange to make a tight joint. The plugs thus fitted were tight and could be easily removed or replaced when desired. The same gasket could be used for an indefinite time. A good graphite lubricant was used on all the threads of all the plugs.

OTHER DETAILS OF THE EXPERIMENTS.

By varying the connections of the draft gauges during the early trials it was found that the draft was seriously interfered with by the resistance of the uptake. The uptake was accordingly increased in size for the later trials, with the result that the boiler showed a greater capacity, the fire room temperature was much lower, and there was no further trouble, as there had been previously, with the burning of grate bars. The variation of draft pressure within the boiler, together with the improvement that resulted from the change just alluded to, is shown diagrammatically in Fig. 3.

In the accompanying tables of the individual trials the "pounds of air per pound of carbon" is calculated by the approximate formula:

$$\frac{11.55\ (CO_2+o+\frac{1}{2}\ CO)}{CO_2+CO}$$

which takes no account of the air consumed in burning hydrogen. In the table of summaries the weight of dry gas per pound of carbon is calculated by the accurate formula as there given. The amount of smoke is designated in a rather crude manner by a scale in which 0 stands for no smoke and 5 stands for very thick smoke.

The first six tests were run by a crew of firemen experienced in torpedo boat work, but the remaining eleven tests were made by firemen picked up around the wharves, not one of whom had ever before fired a boiler under forced draft conditions. Careful examination of the boiler after each of the tests showed no distortion of the tubes, nor any damage to the boiler.

The notes that are recorded in connection with the several tests will show the severe work to which the boiler has been

Summary of Seventeen Tests of Hohenstein Marine Boiler.—(Continued.)

Number of trial.	Approximate fire-room air pressure.	Water.				Economic results.				Fuel per hour.						Water per hour.				
		Total weight of water fed to boiler pounds), (corrected for inequality of water level and steam pressure at beginning and end of test).	Equivalent weight of water evaporated into dry steam (pounds), (37)×(35).	Factor of evaporation (H—h)÷965.7.	Equivalent weight of water evaporated into dry steam from and at 212° F. (pounds). (38)×(39).	Feed water per pound of coal as fired (pounds), (37)÷(23).	Equivalent evaporation from and at 212° F. per pound of coal as fired (pounds) (40)÷(23).	Equivalent evaporation from and at 212° F per pound of dry coal (pounds), (40)÷(33).	Equivalent evaporation from and at 212° F. per pound of combustible (pounds), (40)÷(34).	Coal as fired per hour (pounds), (23)÷(3).	Dry coal per hour (pounds), (33)÷(3).	Combustible per hour (pounds), (34)÷(3).	Coal as fired per hour per square foot of grate (pounds), (45)÷50.14.	Dry coal per hour per square foot of grate (pounds), (46)÷50.14.	Combustible per hour per square foot of grate (pounds), (47)÷50.14.	Feed water per hour (pounds). (37)÷(3).	Water per hour corrected for quality of steam (pounds), (38)÷(3).	Equivalent evaporation from and at 212° F. per hour (pounds), (40)÷(3).	Equivalent evaporation from and at 212° F. per hour per square foot of grate (pounds) (53)÷50.14.	Equivalent evaporation from and at 212° F. per hour per square foot of heating surface (pounds) 53)÷heating surface
1	8	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
1....	0	76,016	74.455	1.134	84,430	7.82	8.69	8.73	9.74	1,215	1,209	1,085	24 2	24.1	21.6	9,502	9,307	10 554	210	4.85
2....	1	86,673	81.260	1.133	92,060	8.30	8.81	8.86	9.86	1,741	1,732	1,557	34.7	34.5	31	14,446	13 543	15 343	305	7.05
3....	2	79,803	78,700	1.133	89 170	7.55	8.44	8.48	9.52	2,642	2,629	2,341	52.6	52.4	46 7	19,951	19,675	22,292	445	10.25
4....	0	77,953	77,120	1.142	88 070	9.03	10.20	10.28	11 26	1 079	1,071	977	21.5	21.3	19.5	9 744	9 640	11 009	219	5.06
5 ..	1	92,458	91.300	1.150	104,740	8.65	9.79	9.87	11 41	1,782	1,769	1.530	35.5	35.2	30.5	15 410	15 180	17.457	348	8.03
6 ..	2	60,539	59 800	1.163	69 540	7.15	8.22	8 28	9 69	2 417	2,398	2,051	48.2	47 8	40.8	17,297	17 086	19 869	396	9 14
7 ..	0	68,415	67.450	1.147	77 360	8.50	9.60	9.91	11.30	1,007	975	855	20.1	19.4	17	8,552	8 431	9,670	193	4.53
8 ..	1	80,747	78 800	1.153	90,950	8.33	9.38	9.68	10.66	1,616	1.566	1,422	32.2	31 2	28.3	13,458	13 133	15 158	302	7.11
9 ...	2	71,644	70,200	1.169	82 070	7.96	9.12	9.42	10.63	2 250	2,179	1,931	44.8	43.4	38.4	17.911	17,554	20,518	411	9.64
10 ...	0	70,148	69.300	1.154	79 980	8.45	9 64	9.84	10.76	1,037	1,016	929	20.7	20.2	18.5	8,769	8,663	9 998	199	4.69
11 ...	0	65.430	64,570	1.157	74,710	8.80	10.05	10 16	11.77	930	919	794	18.5	18.3	15 8	8,179	8,071	9 339	186	4.38
12....	1	70,273	69,070	1.159	80 060	8.38	9.55	9 70	11.69	1 398	1,376	1 142	27.8	27.4	22.7	11.712	11 512	13 343	266	6.26
13....	2	86 194	84.370	1 189	100 320	8.06	9.38	9.48	10.79	2,674	2 647	2 324	53.4	52.8	46.2	21.549	21.092	25,080	500	11.77
14 ...	1	108,763	106,580	1.176	125 350	7.75	8.94	9.00	10.10	2,338	2,321	2 068	46.6	46.3	41.2	18.127	17 763	20 892	417	9.81
15....	0	81 018	79.790	1.155	92,160	8.82	10.04	10.11	11.59	1 148	1,139	994	22.9	22.7	19.8	10,127	9 974	11.520	229	5.40
16 ..	2	92,423	90 390	1.182	106,840	7.33	8.47	8.53	9.52	3 153	3,130	2 809	62.9	62.4	56	23,106	22 598	26,710	533	12.54
17....	3	77.857	75,820	1.193	90,450	7.17	8.33	8.39	9.53	3.621	3,594	3,163	72.2	71.7	63.1	25,952	25 273	30 150	602	14.15

Number of trial.	Approximate fire-room air pressure.	Chimney-gas analysis.					Heating balance or distribution of the heating value of the combustible.														
		Carbonic acid CO_2 (per cent).	Oxygen, O (per cent).	Carbonic oxide, CO (per cent).	Nitrogen, N (per cent by difference).	Pounds of dry gas per pound of carbon [11(56)+8(57)+7(58)+7(59)]÷[3(56)+3(58)].	Heat absorbed by the boiler (B. T. U.'s), (44)×965.7.	Loss due to moisture in coal (B. T. U.'s).	Loss due to the moisture formed by the burning of hydrogen (B.T.U.'s).	Loss due to heat carried away in the dry chimney gases (B. T. U.'s).	Loss due to the incomplete combustion of carbon (B. T. U.'s).	Loss due to unconsumed hydrogen etc. to heating moisture in air to radiation etc. (B. T. U.'s).	Heat value of one pound of combustible calculated from ultimate chemical analysis (B. T. U.'s).	Heat absorbed by boiler (per cent).	Loss due to moisture in coal (per cent).	Loss due to moisture formed by the burning of hydrogen (per cent).	Loss due to heat carried away in the dry chimney gases (per cent).	Loss due to incomplete combustion of carbon (per cent).	Other losses due to radiation, etc. (per cent by difference).	Of boiler (per cent), 61÷(67)×100.	Of boiler and furnace (per cent), 965.7 (43)÷B. T. U.'s per pound of dry coal ×100.
1	8	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
1....	0	9 85	6.85	1.67	81.63	21.5	9,400	7	486	2,320	1,325	1.853	15 391	61	0.1	3.2	15.1	8.6	12	61	60
2....	1	9.46	6.50	1.96	82.08	21.7	9 520	7	505	2,970	1,571	818	15,391	61.8	.1	3.3	19.3	10.2	5.3	61.8	60.8
3....	2	12.42	4.85	1	81.73	18.7	9,190	8	566	3 930	682	1 015	15,391	59.7	.1	3.7	25 5	4.4	6.6	59 7	58.2
4....	0	11.08	4.75	2.19	81.98	18.8	10,870	11	492	2,290	1,388	73	15,124	71.8	.1	3.3	15.1	9.2	.5	71.8	68.3
5 ...	1	10 35	5.03	2.20	82.42	19.8	11,020	12	487	2,400	1,569	—364	15,124	72.8	.1	3.2	15.9	10 4	—2.4	72.8	65.6
6....	2	13.77	3.73	.93	81.57	17.2	9,360	14	564	3,570	567	1,049	15 124	62	.1	3.7	23.6	3.7	6.9	61.9	55
7....	0	9.26	6.48	1.52	82.74	23	10,910	43	555	2 050	1,265	861	15.684	69.5	.3	3.5	13.1	8.1	5.5	69.6	64.4
8 ...	1	8.87	6 94	1.59	82.60	23.6	10.290	44	584	2,650	1,362	754	15 684	65.6	.3	3.7	16.9	8.7	4.8	65.6	63
9 ...	2	9.20	6.40	1.70	82.70	23.7	10.260	46	600	2,800	1,398	580	15,684	65.5	.3	3.8	17.8	8.9	3.7	65.4	61.3
10	0	8.89	....	.....	....	..	10,390	27	501	.....	....	.....	15 475	67.1	.....	3 2	....	....	...	67.1	63.3
11....	0	8	.....	....	.....	.....	11 360	16	496	....	....	.....	15,475	73.4	.....	3.2	.....	.....	...	73.4	65.4
12 ...	1	7.15	.....	.....	.....	.....	11,290	24	516	.....	.....	.....	15 475	72.9	.....	3.3	.....	.....	.....	73	62.4
13....	2	8.64	.....	.....	.....	.....	10,410	15	551	.....	.....	.....	15,475	67.2	.....	3.6	.....	.....	.....	67.2	61
14....	1	8.10	.....	.....		.....	9,750	11	565	.....	....	.....	15,475	63	.....	3.7	.....	.....	.....	63	57.9
15....	0	7.90	11.4	.90	79.80	28.1	11,190	11	521	2,740	908	105	15,475	72.2	.1	3.4	17.7	5.9	.7	72.3	65
16 ...	2	8.90	9	1.10	81	24.8	9,190	11	577	3,880	989	828	15,475	59.4	.1	3.7	25.1	6.4	5.3	59 4	54.9
17....	3	9.70	9.1	.60	80.60	23.8	9.200	12	600	4.380	519	764	15.475	59.4	.1	3.9	28.3	3.4	4.9	59.4	54

exposed. Under these several trials the boiler shows no indication of injury whatever. Not a leak has developed and not a tube has been bent. The tubes have frequently been examined, and they are clear of mud, showing that a good circulation has been maintained. The casing of the boiler has not proved satisfactory, the lining not being able to stand the effect of strong forced draft. This has been probably due to the use of improper non-conducting material. This defect is one which can be easily remedied by a more liberal use of fire tile or fire brick.

The front drum is only 24 ins. in diameter. Although this boiler is so baffled that it has given reasonably dry steam, and the design of the boiler is such that there is a much greater water surface in the drums, and at least an equal weight of water to that used in other water-tube boilers, yet the board considers that for marine work, where the ship will roll and pitch, and thus cause the water level to vary, the front drum should be increased to about 42 ins. in diameter.

With an improved casing and a larger front drum for the boiler, the series of experiments conducted indicate that this boiler is a satisfactory steam generator for the naval service. The board therefore recommends that the Hohenstein boiler be given a place on the very limited list of straight-tube water-tube boilers of American design that have been found suitable for naval purposes. The board believes that the important question of selecting an approved water-tube boiler for naval purposes will be finally settled by a process of selection from types installed on board ship, and subjected for several years to the stress of service conditions. In order, therefore, to assist in discovering an approved type that will meet the requirements of the navy, the board recommends the use of the Hohenstein boiler on an American warship, preferably one requiring a large installation.

(Members of the board are John R. Edwards, Wythe M. Parks and Frank H. Bailey, all lieutenant commanders.)

J. U. Karr, dealer in vessel supplies at Cleveland, bought the schooner Donaldson at marshal sale in Toledo a few days ago for $1,225. Claims against the vessel aggregated $1,200. She has been in service thirty-five years.

THE AMERICAN MERCHANT MARINE.

While the navy of the United States has been the subject of many volumes, comparatively few have been written about the merchant marine, which offers such a wide field for interesting history. An awakening in this line, however, seems to be under way, two notable volumes having been issued recently. One, "The American Merchant Marine" by Winthrop L. Marvin, is a work of decided interest.

Mr. Marvin's volume is devoted to a history of American ships and sailors, beginning even before the Mayflower and continuing to the great seven-master just returning from her maiden trip. It is written in an attractive style, without attempt at argument, but with a plea for the restoration of our country's lost supremacy of the seas. All phases of shipping are carefully described. We are told about the little packets that made old Salem famous, the whalers that made New Bedford's fame, the trim clipper ships that came from towns in Maine, which for years have been almost forgotten, but are now springing into activity owing to the encouraging prospects in coastwise trade. The wonderful exploits of the crews of these famous old vessels offer thrilling topics for the story writer and the historian, and Mr. Marvin has made the most of them, presenting a story that is never dull and yielding information in its best form on every page.

Ship building is the most ancient of American industries, for the ill-fated colony at Popham, at the mouth of the Kennebec, launched in 1607 "a faire pinnace of thirty tons," the Virginia, which safely crossed the Atlantic. The first decked vessel, however, was built on the Hudson in 1614. The first sea-going ship of Massachusetts was the Blessing of the Bay, built at Medford, and in 1641 there was launched at Salem a ship of 300 tons, a prodigious craft for those days. These were half traders, half fighters and sailors were obliged to be expert in the use of great guns and of musket, pike and cutlass as well as to know now to "hand, reef and steer." Altnough the builders in the early times were expert workmen, they did not have the tools or machinery of the workers of today, and ship for ship their vessels were not so strong as modern vessels.

Between 1789 and 1828 congress passed no less than fifty laws in aid of shipping and a rapid gain followed. It is to this era that belong the voyages of the Columbia to the northwest coast, the first vessel to circumnavigate the globe; of the Massachusetts to Java and China, and of the Hope to Oceanica and the North Pacific. During the last twelve years of the eighteenth century there was a falling off in shipping in only one year, and this was due to the depradations of the Barbary corsairs of the Mediterranean, who were deliberately protected by the great christian nations of Europe. Congress finally authorized the building of warships to enforce protests against the outrages, but before they were completed a treaty was made with the dey of Algiers, which bound the United States to pay him $1,000,000 in money and presents, a disgraceful tribute, indeed! The Lady Washington, a vessel owned by several Boston young men who afterwards became famous, was the first vessel to display the stars and stripes in Japan. The Columbia, previously mentioned, did much to secure for the United States a grip on the Oregon territory, and her monument is the great river which bears her name.

The story of the long period of impressment and embargo is told in a concise yet comprehensive manner; then follows a chapter on the Yankee whaleman, which naturally is filled with thrilling adventures of these bravest of sailors. The red aborigines were really the first American whalemen. They went out in canoes to capture the monsters; and these Indian canoes were the models of the first whale boat, which form in its essential features is still retained. In 1846 the American whaling fleet consisted of 678 ships and barques, thirty-five brigs and twenty-two schooners, with a tonnage of 233,189, valued at $21,075,000. The average life of a merchant vessel is fifteen years, but Mr. Marvin reports the sale of the whaling ship Maria at Talcahuano, Chile, in 1863, at the age of eighty-one. He might well have added to his list the sloop Polly, which was built at Amesbury in 1850, and is still knocking around the Maine coast. Great profit was made by some of these whalers; two vessels in 1855 caught two whales which resulted in a profit of about $5,000 each for the day's work. Another in two years and eight months sold sperm oil worth $88,000. A defiant skipper who put to sea in 1864, in the dangerous days of the war, returned in 1865 with whale products worth $150,000. The whaling fleet is now only one fifteenth of its numbers in 1846.

From 1789 to 1815 American shipping had been carefully fostered, but then began a change of policy which eventually proved disastrous. Several new enterprises were started between 1815 and 1830, one of them being the first transatlantic passage of a ship equipped with steam power. She created a tremendous sensation in England. Salem, through the energy and enterprise of her merchants and sailors, was for a long time the most prominent port in the United States, and her history in this connection reads like a romance. One bold mariner discovered pepper growing wild in Sumatra, and made several secret voyages to secure cargoes which gave Salem control of the pepper supply of nearly all the world. Another, while at Zanzibar, in 1831, secured a corner on gum-copal, which is essential to the manufacture of varnish, and Salem become the center of this trade. The West India trade was the oldest of all and Salem ships and sailors followed this for two full centuries. The old town held considerable commerce up to the outbreak of the civil war. The last entry at Salem from India was in 1845, the last from Havana in 1854, the last from South America in 1877, and then ended Salem's glorious foreign trade. On June 30, 1900, that port owned not one vessel of any kind permanently registered for deep sea commerce.

The magnificent fleet of clipper ships built after 1850 had no equal before and has had no superior since in speed, power and beauty. Great speed was developed in the rush to California when haste meant so much to the anxious "forty-niners." Capt. Lauchlan McKay made the run from New York to San Francisco in 102 days and a part of the time was under jury-rig, owing to an accident. The year 1855 marks a turning point in American shipping; several of the steam fleet were wrecked, and political differences in congress brought about disastrous acts. "The Merchant Marine in that critical period of transition from sail to steam," writes Mr. Marvin, "was truly and decidedly the victim of the feud between the States." The deep-sea fishery for cod and halibut and mackerel is older than whaling, and even now, though our fleet has dwindled in size, it is incomparably the first in quality. The fleet, however, no longer grows; its tonnage has hardly changed for four years. This industry, so full of peril and excitement, is the topic of a most interesting chapter, and the volume closes with a history of shipping on the great lakes, where the United States is supreme, controlling nine-tenths of the shipping. The volume is attractively bound, well printed, has a carefully arranged index, is well supplied with tabulated statistics, and should have a permanent value as a work for reference. The other work by Capt. William W. Bates, former United States commissioner of navigation, will be noticed later.

Capt. Edward P. Blair of the Northern Wind was in the habit, and for the matter of that is yet in the habit, of visiting the customs house at Superior to make his usual report after each trip to the government. He is the Aucassin of this story. It so chanced that in the office of the inspector was a stenographer yclept Lucille Vivien Shields, whom the fates betold should be of goodly mein and fair withal. She is the Nicolette of this story. Now witness what happeneth to the captain. Be any mortal so dull as not to divine that the business of writing manifests grew exceeding pleasant or that the captain was prone forsooth to tarry at his task. This be the pleasant season of life, and yet, strange as it may appear, one hastens to have it over with. So with this north country Aucassin. He pressed the fair Nicolette, under the guise of bestowing favor upon companions of hers, to journey with him on the Northern Wind and wooed her betimes. Surely is the fair Nicolette to be blamed for thinking it better than striking types? Now riddle you what befell the maid. She returns to her home; she caresses her father and mother but does not tell them her secret, yet wonders that they cannot perceive the great light that is beating in on her; then under pretense of making a call she leaves the house and enters the portals of the church where Aucassin is waiting. And lo, she is no longer Shields but Blair.

TRADE NOTES.

The Joseph Dixon Crucible Co., Jersey City, N. J., issue a great abundance of reading matter, all of which, too, is very well done. The latest is a little folder devoted to Dixon's silica-graphite paint for protection of heated surfaces. The cover is illustrated with a photo of the Fall River steamer Priscilla, which is painted with silica-graphite paint. This paint is warranted to stand severe conditions for a great length of time.

Knecht Bros. Co., Cincinnati, O., say that no one takes a risk when he buys the Knecht sensitive friction drill, as all the company's machines are guaranteed. "For the manipulation of a variety of work," they say, "the sensitive drill press, drilling accurately and rapidly, has no equal. For tool room, model shop, instrument makers, manufacturing jewelers, electricians and inventors it is indisputably a necessity and labor saver."

The Acme White Lead & Color Works of Detroit, Mich., is sending out a dainty portfolio of prominent lake vessels to its patrons. The plates are bound in a green cover with cord and so arranged that the additions as they are issued can be fastened within the cover. The plates are well made. The two which have just been issued are those of the steamer Isaac L. Elwood and the North West. Both are printed on yellow tint blocks. The portfolio is issued to advertise the Neptune Marine paint and the New Era marine varnishes which are made by the company. These paints and varnishes are guaranteed as the best to be obtained.

The Chicago Pneumatic Tool Co. report a very large increase in sales during the past few weeks and all of their factories are working night and day in an endeavor to fill orders pouring in. Especially is this the case in the air compressor department. The factory at Franklin, Pa., is being pushed to its utmost capacity. Mr. J. W. Duntley, president, is still continuing his business trip on the European continent and large orders from him are being received by the Chicago office for pneumatic tools, annealing machines, rivet forges, etc. His return is not definitely announced although he will in all probability leave for this country in the very near future.

Appointments of local representatives in several lake cities, made recently by the marine department of the Standard Oil Co., which now has headquarters for the lakes in the Perry-Payne building, Cleveland, seem to indicate plans for a very thorough organization. At Duluth the marine department will hereafter be represented by W. W. Smith, at Milwaukee by W. H. Ballard and at Detroit by E. A. Fitzgerald. These gentlemen will give special attention to the marine trade. Messrs. Smith and Ballard will be located at once in the offices of the Standard Oil Co. at Duluth and Milwaukee, respectively, but Mr. Fitzgerald will not take up the Detroit work until Jan. 1.

John F. Allen, No. 370-372 Gerard avenue, New York, has issued a catalogue devoted to Allen pneumatic machine tools. In his preface he addresses the manufacturers of elevated railroad, bridge and boiler work, saying that his many years of experience in devising and manufacturing the line of machinery described in the catalogue has enabled him to produce many improvements that could not suggest themselves to those unfamiliar with the requirements of their lines of work. Continuing he says: "Our pneumatic compression bridge riveters are indispensable. Our machines have entirely displaced the portable hydraulic pressure riveters, as the use of compressed air of 60 lbs. pressure is much more convenient than that of water under a high pressure of 2,500 lbs., which requires the use of cumbrous iron piping with socket joints. We make the only portable pneumatic percussion and compression riveters." The catalogue contains a complete description of the riveters and is crowded with testimonials. The catalogue will be sent to anyone interested upon request.

A few of the circulators and steam jets for steam boilers made by H. Bloomsburg & Co. of 700 Dolphin street, Baltimore, Md., were some years ago installed on lake vessels. These devices have since made their own way with little or no effort to push the sale of them. The Jenks Ship Building Co. of Port Huron purchased ten of the circulators some time ago and are now ordering four 2½-in. feed and four steam heating circulators. Twenty-three of the circulators have of late been furnished to vessels of the United States lighthouse service. The new Pacific Mail liner, Korea, which recently broke the record for passage of the Pacific, has fourteen sets of the circulators. Capt. H. Bloomsburg, representing the manufacturers, is now making a tour of the lake cities. Both circulator and steam jet, the latter a system of induced draft, are very reasonable in cost. Capt. Bloomsburg's principal object in visiting the lakes was to call upon the Jenks company and to see Chief Engineer Hayes of the Pittsburg Steamship Co. (Steel Corporation), who contemplates putting the circulators into some of the Steel Corporation vessels to be laid up at Duluth during the coming winter.

The Pittsburg Blue Print Co., 1505 Park building, Pittsburg, has issued a catalogue devoted to its patent cylindrical electric copier. The company has already installed over 100 of them in the offices of some of the largest and most conservative concerns in this country. The copier is, of course, entirely independent of the sun. The standard upright machine is regarded as the best type for almost all work. It consists of two half-glass cylinders, bent to practically true curves, bound together with brass bands top and bottom, and having wooden strips between the edges of the glasses. A strong canvas cover fits around the glass to hold the tracings and paper in place and insures good contact. The cylinder rests on a base, which is mounted on wheels and revolves about the axis of the cylinder. An arc lamp of special design and construction is suspended by chains, which pass over the sheave wheels on the bracket and are attached to a counterweight on the back of the machine, the lamp being slightly heavier than the counterweight. Another chain connects the counterweight with the drum of the auto-gear or escapement mechanism for regulating the speed of the lamp in its descent. In operation the tracing and sensitized paper are placed between the glass and canvas cover, and the lamp passing axially through the cylinder gives uniform exposure to all parts of the print.

REMARKABLE TEST OF SUBMARINE BOAT ADDER.

It appears that the submarine torpedo boat Adder underwent a sensational trial in the recent tests in Peconic bay. According to the experts who were watching the test she succeeded in firing a torpedo at a battleship. According to the rules, the Adder was to make a two mile run straightaway under water with the privilege of rising three times for observation and not more than a minute each time. The actual test, however, was a much more severe one, for by the consent of the board the Adder traveled a mile under water, turned in remarkably quick time without rising to the surface and then ran back over the course and fired her torpedo at the end of the mile. She made a speed of 7½ knots over the entire course, and only rose to the surface twice, occupying forty seconds the first time and thirty-five seconds the latter. At the request of the board a periscope was attached to the boat before leaving her dock, not for use in the submerged run, but for the board to inspect afterward. This device, used for ascertaining the position of objects on the surface when the boat carrying it is submerged, consists of a mirror at the top of an iron tube about 15 ft. above the deck amidships, its lower end being in the hold of the boat, where the observer stands. The reflection of objects on the surface is conveyed to him by a system of lenses. This iron tube interfered with the trial, for its local attraction threw the compass out of adjustment, and it also retarded the speed of the boat sufficiently to upset slightly the calculations of Capt. Cable while steering under water.

The Adder came out of the basin at New Suffolk at 8:30 a. m., on Saturday last and half an hour later she began a preliminary surface run over the two mile course to test her compass. On board, besides Capt. Frank T. Cable, were Chief Electrician Harry Morrell, Lieut. White, U. S. N., Naval Constructor J. J. Woodward, U. S. N., Manager Lawrence Spear, and six men to run the engine and handle the torpedo, which was to be launched from a tube in the bow, about 3 ft. below the surface. All was ready for the submerged run at 10 a. m. It had taken just eight minutes from the time all hands disappeared below to sink the boat until only her conning tower and mast were visible. This time could be cut down half, the submarine experts say, in actual service. The Adder, going at full speed, made her first dive almost immediately, sinking until only about 8 ft. of her periscope mast was out of the water. The mast and the stays supporting it made a little fuss where they cut the water, leaving a narrow, white wake. In actual war service, however, it is said, with no mast in, not a ripple is seen, so that a warship would have absolutely no warning of the approach of one of these submarine terrors. In 8 minutes and 35 seconds after the start a little mast was passing the flags marking the mile, and almost immediately the helm was put hard a-starboard. The boat turned faster under the water than she had ever done on the surface. In 1 minute and 25 seconds she had described a complete circle and was passing the flags, beginning her second mile when two minutes had elapsed. Her conning tower shot into sight like the hump of a whale coming up to blow. Soon down she went, not coming to the surface again until within an eighth of a mile of the finish. Dangerously near to what would have been a battleship she steered, when suddenly her bow shot high out of the water and the torpedo was launched. At a speed of 28 knots an hour the missile sped away to the northward, until its energy was exhausted. Then it was picked up and towed into the basin.

The Adder and the Moccasin went out later on Saturday for their awash test over the half mile course. The weather was breezy throughout the run of the Moccasin, making it difficult for the observer on shore to distinguish the boat when she crossed the ranges. Both boats made the run considerably under their required time, and it is said that the speed of both exceeded that called for in the contract, which was 7 knots.

NEW BATTLESHIPS AND CRUISERS.

Probably no vessels in the United States navy have been more carefully planned than the two battleships and the two armored cruisers authorized in the last naval act. The designs of the two battleships have been completed, the contract for one, the Louisiana, having been awarded to the Newport News Ship Building & Dry Dock Co. The other, the Connecticut, is building at the New York navy yard. Both of the armored cruisers, the Tennessee and Washington, are to be built by contract. The speed of these vessels is to be 22 knots, the same as for the Maryland and St. Louis classes of armored cruisers now building, and 1 knot in excess of the designed speed of the earlier armored cruisers, the New York and Brooklyn. In the designs as finally developed the naval board gave careful consideration to the question of speed, and ascertained that the large increase of horse power necessary to increase the speed beyond 22 knots involved such disproportionate increase in the weight of machinery as to seriously curtail the weights available for battery and protection, and thus seriously affect the offensive and defensive qualities of the vessels. The Tennessee and Washington excel in battery power and protection any armored cruiser built, building, or designed in the world, and they are the equal of a large majority of the battleships of the world. With the high protection and battery, it is asked in what respect these vessels differ from a battleship. The designers say that they bear the same relation to the battleship as the cavalry does to the infantry in the army. With 4 knots greater speed than the vessels of the Connecticut class of battleships, they are able to move more quickly from point to point, and with their excess of speed over the battleships they are able to give battle or run away from the enemy's battleship as they please, and with their powerful offensive and defensive qualities they are able, in case of necessity, to put up a stiff fight with the finest battleship afloat, with a fair chance of winning out.

DEVELOPMENT OF TRADE WITH CHINA.

Rear Admiral Robley D. Evans, commander of the Asiatic squadron, has made a report to the navy department of his recent trip up the Yangste river in the Helena to investigate the conditions in the interior of China. It was feared at the time that the Boxers were on the verge of an uprising but Admiral Evans, writing from Ichang, says the abundance of the crops indicates a plentiful supply of foodstuffs and he thinks there is little probability of rioting and other disturbances due to famine. Admiral Evans says the most important single American interest in that section is the concession granted last June to the American-China Development Co. for the construction of a railroad from Canton to Hankow. The road is 700 miles long, and the route chosen lies along that followed by the traders between North and South China for centuries, and penetrates many large commercial cities. A survey was made of the route in 1896-7, but the Boxer outbreak prevented further progress until last June, when the Peking authorities ratified the final terms of the concession. These terms require that the road shall be broad gauge, well built and completed, so far as practicable, within three years. The initial paid capital of the company is $3,000,000. The concession is for eighty years, at the end of which time it reverts to the Chinese government on payment of the market value of the stock. The right is reserved by the government to purchase the road under the same terms at any time after forty years. In the construction of the road, Admiral Evans says, the company has an agreement with a Belgian syndicate to give preference to Belgium in the purchase of material, provided it cannot be bought more advantageously in America. The entire management of affairs, the admiral reports, is in the hands of Americans, who have their main office in Shanghai. Preparations are under way to begin work at Wu-Chang and Canton, the terminal points, and work toward each other. Admiral Evans regards the concession the most valuable yet granted by the Chinese government to the people of any country, and if carried out along the lines intended he thinks it will greatly enhance American prestige in the Orient. Because of the large amount of material necessary for construction purposes, it is reported that the company will start a special line of freight steamers from Seattle to Canton and Hankow.

Seven months ago the Hamburg-American liner Deutschland tore out her stern posts and rudders and steered into Cherbourg with her screws. Thorough and extensive repairs were made and she sailed from Hamburg on Nov. 6. Just after passing Nantucket a bolt of the third crank shaft bearing broke, cracking the low-pressure cylinder cover. Steam was instantly shut off and further damage avoided. The liner reached dock under the port engine.

MAY BUILD MORE STEAMERS.

The surprisingly fast time made by the new mammoth steamship Korea of the Pacific Mail Steamship Co.'s fleet, which arrived in San Francisco from Yokohama Oct. 28, is causing much comment on the Pacific coast. The Korea made the trip from Yokohama to San Francisco in ten days. The ship came by the direct route, which is 4,700 miles long, and the average daily run for the passage, therefore, was 470 miles. This is a new low record for a trans-Pacific passage, being four days shorter than the best record time on the ocean hitherto. The Korea, which is the largest ship ever built in America, was not constructed for speed alone. The Korea and her sister ship the Siberia, do not surpass the St. Louis and St. Paul in speed and passenger accommodations, but they do surpass them considerably in their dimensions, in freight carrying capacity and in tonnage and displacement. The Korea is 550 ft. long between perpendiculars.

Owing to the rapid development of Japan, as a whole, and many sections of China, and the entrance of the United States into the Philippines, the traffic between the principal points in those countries and San Francisco has increased at a phenominally rapid rate within the last few years. These conditions forced the Pacific Mail Steamship Co. to build and put into commission the Korea and the Siberia, and it may be stated on official information that other vessels are already in contemplation.

The enterprise of the Pacific Mail Steamship Co. is apparent when it is recalled that they were the pioneers in the introduction of large and well-equipped passenger and freight steamers on the Pacific ocean. The Tokio and Pekin were the company's first vessels of this class, and have been extremely popular. Now the company has taken the lead again by the building of the Korea and Siberia, not only the largest steamships on the Pacific ocean, but the largest ever built in America. The officials of the company are confident that, with the introduction of these large and handsomely-equipped ships into the Pacific trade, the passenger traffic on their lines will also make rapid strides.

As already intimated the Siberia, the sister ship of the Korea, and a duplicate of her, will be put in commission in the China line as soon as completed. Both of these vessels have a displacement of 18,000 tons. The well-known and very popular steamship China of the same line, which has been in the same service for some time, has a displacement of 12,000 tons. Nothing has been overlooked in the equipment of the passenger departments of both the Korea and Siberia. They have accommodations for 250 passengers.

The treasury department has allowed a drawback on wire rope used in marine cable manufactured by the Safety Insulated Wire & Cable Co. of New York.